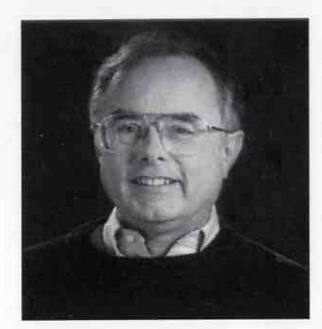
Fortress



The Maginot Line 1928–45

William Allcorn • Illustrated by Jeff Vanelle & Vincent Boulanger



WILLIAM ALLCORN, a former US army officer who served in Vietnam, has a long standing interest in forts and fortifications of all eras, and over the years has visited and photographed many sites. For several years he lived in Luxembourg and Germany, which afforded him the opportunity to extensively visit and explore the heart of the Maginot Line. William has acted as a historical consultant for several documentary television programmes on fortification related topics, and has written several articles for *FORT*, the journal of the Fortress Study Group. He lives in Southern California.

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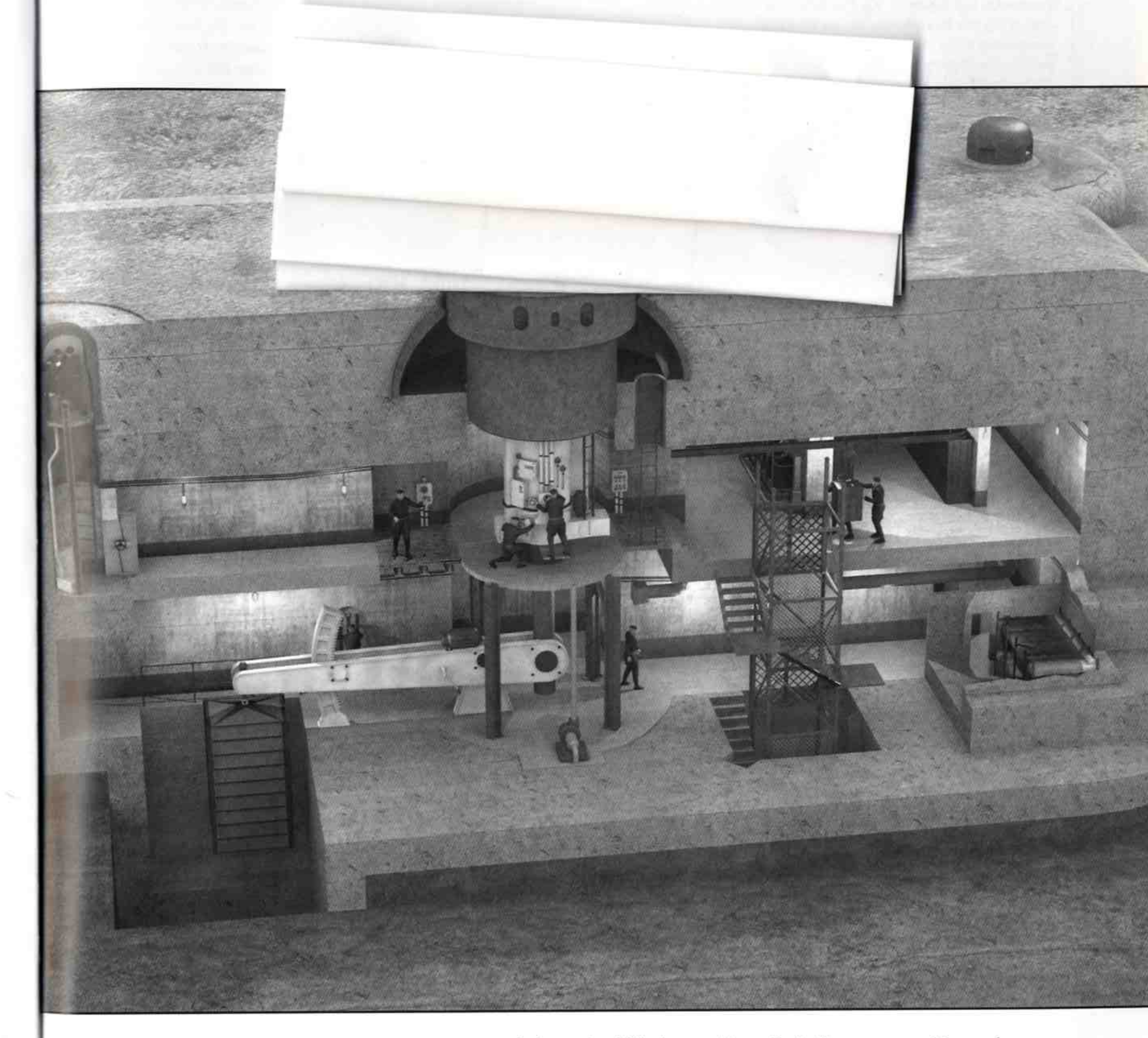
VINCENT BOULANGER was born in Paris. He studied art at the ESAG (École superieure d'art graphique), and then began work as a freelance illustrator. He has produced illustrations for numerous publishers and commercial organisations, and has also worked as a designer for computer games and as a comic book illustrator. Vincent lives in Clisson, Brittany, with his wife and two sons.

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Series editors Marcus Cowper and Nikolai Bogdanovic

First published in Great Britain in 2003 by Osprey Publishing, Elms Court, Chapel Way, Botley, Oxford OX2 9LP, United Kingdom.
Email: info@ospreypublishing.com

ISBN 1 84176 646 1

Editorial: Ilios Publishing, Oxford, UK (www.iliospublishing.com)
Proofreading: Bob Munro
Maps by The Map Studio, Romsey, UK, and Eric Halter
Line drawings by Eric Halter and John Richards
Index by Alison Worthington
Design: Ken Vail Graphic Design, Cambridge, UK
Originated by Grasmere Digital Imaging, Leeds, UK
Printed and bound by L-Rex Printing Company Ltd.

03 04 05 06 07 10 9 8 7 6 5 4 3 2 1

A CIP catalogue record for this book is available from the British Library.

FOR A CATALOGUE OF ALL BOOKS PUBLISHED BY OSPREY MILITARY AND AVIATION PLEASE CONTACT:

Osprey Direct UK, PO Box 140, Wellingborough, Northants, NN8 2FA, United Kingdom.
Email: info@ospreydirect.co.uk

Osprey Direct USA, c/o MBI Publishing, PO Box 1, 729 Prospect Ave, Osceola, WI 54020, USA.
Email: info@ospreydirectusa.com

www.ospreypublishing.com

Acknowledgements

Portions of the text and the figures on which the illustrations on pages 10 and 35 are based originally appeared in issues 14 (1986) and 15 (1987) of *FORT, the International Journal of the Fortress Study Group*.

I would particularly like to thank several individuals without whose help this book would not have been possible: Albert Haas for making available the photos he took while serving in the Maginot Line in 1939 and 1940; Eric Halter for the immense amount of work he put in and patience he showed preparing the maps and plans for the book; Marc Halter for reviewing the text, for taking photographs for the book at the last moment, and for a wide range of other advice and assistance; J.E. Kaufmann for reviewing and providing valuable comments on the text; Terry McGovern for providing photographs for the book; Paul Szymanski for making available his extensive collection of World War II photographs, and Hans Vermeulen for a photograph and useful information for the book.

Finally, I would like to express my thanks to all those who have given their time and effort to documenting, preserving, and restoring Maginot Line fortifications.

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Conversion table

1 millimetre [mm]	0.0394 in.
1 centimetre [cm]	0.3937 in.
1 metre [m]	1.0936 yards
1 kilometre [km]	0.6214 miles
1 kilogram [kg]	2.2046 lb
1 tonne [t]	0.9842 long ton (UK)

Abbreviations

The following abbreviations are used on the fortification plans in this volume:

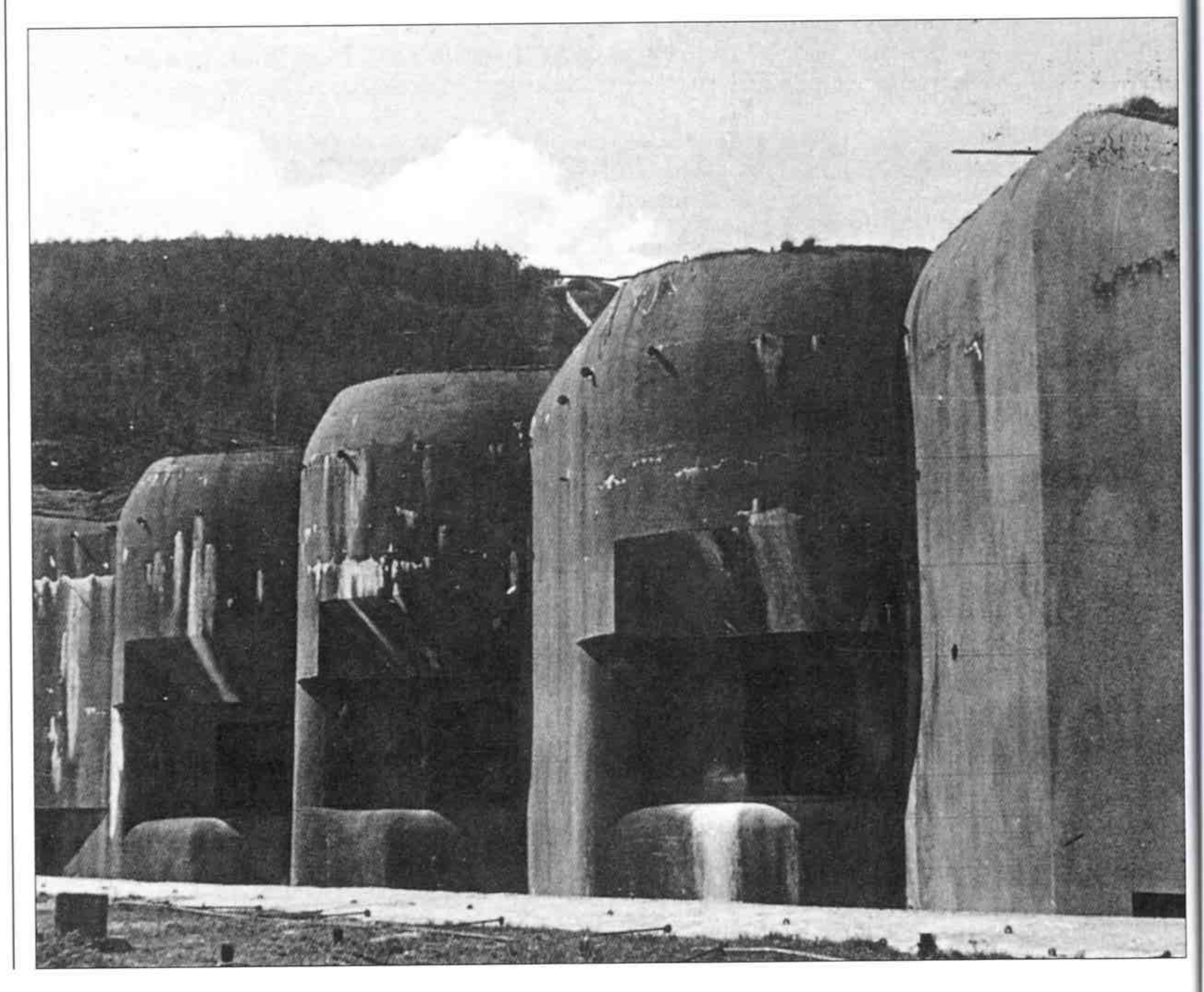
A	Accommodation
AR	Automatic rifle
AS	Access shaft with stairs only
AT	Anti-tank gun/anti-tank
BI	Infantry combat block (Alps)
C135	135mm howitzer casemate
C75	75mm gun or 'mortar' (Alps) casemate
C81	81mm mortar casemate
CC	Infantry combat block with *cloches* only
C-GL	Grenade launcher *cloche*
CI	Infantry casemate block
C-MA	Mixed-arms *cloche*
CO	Commanding officer's accommodation
C-O	Observation *cloche*
C-O/AR	Observation and automatic rifle *cloche*
CP	Command post
D	Ditch
E	Entrance
EG	Entrance block for garrison
EM	Enlisted men's accommodation
ES	Entrance block for supplies and ammunition
H	Hospital, medical facilities
K	Kitchen
L	Latrine/washroom
LS	Access shaft with lift
M	Ammunition magazine
MGT	Machine gun turret
M1	*Ouvrage* main ammunition magazine
NCO	Non-commissioned officers' accommodation
O	Officers' accommodation
OP	Observation block
PP	Power plant
S	Store room
ST	Stairs
T	Telephone switchboard
T135	135mm howitzer turret
T75	75mm gun turret
T81	81mm mortar turret
TMG	Twin machine gun
VF	Ventilation and filters
W	Well
WT	Water tank

Contents

Introduction

The Maginot Line, the massive series of fortifications built by France in the 1930s to defend its borders with Germany and Italy, is perhaps the most maligned collection of fortifications ever built, commonly viewed as an abject failure, a disaster for France, a total waste of both money and manpower, and a monument to the folly of static defence. Yet there are those who argue that, to the contrary, it accomplished exactly what it was designed to do. What is not disputed is that the Maginot Line was a technological marvel, far and away the most sophisticated and complex set of fortifications built up to that time. Consisting of massively strong, mutually supporting works of reinforced concrete and steel sunk deep into the ground, proof against fire from the heaviest artillery, immune to poison gas attack, and able to operate self-sufficiently for a month or more, the Maginot Line constituted a thin but formidable barrier to direct attack from Germany or Italy. Yet ultimately, it did not save France from crushing defeat in 1940 and this fact alone shapes the legacy of the Maginot Line today more than any other.

A typical Maginot Line artillery casemate block, in this case combat block 6 of the *gros ouvrage* of Hochwald. The block is armed with three M1929 75mm guns that are oriented to fire along the line of fortifications in order to protect adjacent works. *Gros ouvrages*, literally 'large works', are the partially underground forts for which the Maginot line is so famous. (A. Haas)



Chronology

1918 **11 November** End of World War I. France regains Alsace-Lorraine.

1920 First proposals for fortifying France's expanded borders.

1927 The *Commission d'Organisations des Régions Fortifiés* (CORF) is established to oversee the implementation of the border fortification programme.

1928 Fortification construction begins both in north-eastern France and in the French Alps.

1934 Construction begins on the 'new front' extensions to the original fortifications in northern France.

1935 **13 January** In a plebiscite, the Saarland votes to become part of Germany again.

1935 **August** Fortifications officially named *La Ligne Maginot* (the Maginot Line) in honour of the former Minister of War, André Maginot.

1936 **1 January** With construction of the original Maginot Line fortifications largely complete, CORF is disbanded.

March In response to German re-militarisation of the Rhineland, the Maginot Line fortifications are mobilised for the first time. The fortress troops move into the works and place them on a war footing.

1938 Construction of the 'new fronts' is completed. The Maginot Line is mobilised twice, first in response to the German annexation of Austria, then in response to the German occupation of the Sudetenland.

1939 **21 August** Rising tensions between Germany and Poland cause the French government to again order mobilisation of the Maginot Line.

September Germany invades Poland. France and its allies mobilise and declare war on Germany. Limited French offensive against the German Saarland.

October Start of the 'Phoney War'.

1940 **10 May** Germany launches its offensive against Belgium and Holland; the French Army and British Expeditionary Force advance into Belgium to meet the attack.

20 May German armoured spearheads reach the French coast, cutting the Allied armies in half.

5 June Second phase of the German offensive, the Battle for France, begins with German attacks along the line of the Somme and Aisne rivers.

14 June Germans launch direct attacks on the Maginot Line fortifications in north-eastern France.

15 June German assault crossing against Maginot Line fortifications in the Rhine River valley.

20 June Italy attacks in the Alps.

22 June Franco–German armistice is signed.

25 June Franco–Italian armistice is signed.

July The last Maginot Line *ouvrages* surrender.

1944 **November** Parts of the Maginot Line again see action as the Germans attempt to hold some of the works against advancing American forces.

1946–60 The French military restores and maintains some Maginot Line works as Cold War defences.

1960–70 The French military sells or abandons most of the Maginot Line fortifications.

1970s The first Maginot Line works are opened to the public as tourist attractions.

Historical background

In 1919 France was one of the nominal victors of World War I, but victory had come at great cost. The French armed forces had suffered more than 6 million casualties, the northern provinces had been devastated by fighting, and the country was burdened with a huge war debt. While her politicians worked to impose a punitive peace treaty on Germany in the hope that it would prevent her from ever again posing a threat, the French Army began to consider what military steps could be taken to save France from future invasion.

The army high command was divided. One group under the leadership of Marshal Foch, the supreme allied commander at the end of the war, argued that the best defence was good offence; that should Germany ever again threaten France, France should respond with an immediate offensive across the Rhine. The other group argued that the experiences of the last war, and of the Battle of Verdun in particular, clearly demonstrated the superiority of strong defensive positions incorporating permanent fortifications, and the heavy losses they could inflict on offensive forces operating against them. They argued that in the event of war France would best be served by a strategy of defending behind some sort of permanent fortifications until such time as its allies could come to its aid and a joint blockade could strangle Germany.

Demographic considerations strengthened the arguments of the defensive school. France had a population of some 40 million, Germany 70 million and Germany had the higher birth rate. Beyond that, studies showed that as a result of the war, France would be faced with a significant shortage of conscripts in the second half of the 1930s.

The surface of combat block 3 of the *gros ouvrage* of Rochonvillers. In the foreground and to the right can be seen the block's two armoured observation and automatic rifle *cloches* that provided part of the close-in defence of the *ouvrage*'s surface. To the left is the block's artillery turret in the raised, firing position. It is armed with two M1932-R 75mm howitzers. (T. McGovern Collection)

Planning and building the Line

By the early 1920s the defensive school had prevailed and France began to study how best to defend its frontiers. In the North East it was faced with a clean slate. For hundreds of years, it had relied on permanent fortifications as the basis for border security, but because the newly regained Alsace-Lorraine region in the east had been part of Germany from 1870 to 1918, its current borders with Germany were completely undefended by modern fortifications.



The general distribution of all the fortifications built as part of the Maginot Line programme with the exception of those built in Corsica.

German soldiers and civilians at the supplies and equipment entrance of the *gros ouvrage* of Hochwald shortly after its surrender in June 1940. Entrance blocks provide access to an *ouvrage*'s underground facilities and Hochwald is unique in having three. Two are visible in this picture. Beyond the supplies and ammunition entrance block is one of the *ouvrage*'s two garrison entrance blocks. These blocks are located in covered positions well to the rear of the combat blocks. (Paul Szymanski Collection)



The requirements of whatever scheme was ultimately adopted were that it should:

- prevent any future war from being fought on French soil and in particular secure vulnerable key industrial areas from attack;
- compensate for the superior manpower advantage enjoyed by Germany; and
- provide a shield behind which the French Army could mobilise.

The first official proposal came in May of 1920 from a group lead by Marshal Joffre, the victor of the Battle of the Marne. It proposed a series of fortified zones running from the North Sea to the Alps behind which the French armies could mobilise and seek favourable opportunities to attack. In 1921, a Marshal Pétain, the Inspector-General of the Army, countered Joffre with a proposal that was to become the basis for French strategic doctrine for the next 20 years. His proposal was for 'battlefields prepared in peacetime', by which he meant continuous lines of permanent fortifications analogous to the trench lines of World War I. The fortifications were to run along the Rhine River and from there along France's northern border to the vicinity of Thionville on the Moselle River. Marshal Pétain strongly believed that to the west of Thionville the Ardennes Forest in Luxembourg and eastern Belgium presented such a significant and easily defended barrier that the Germans would not seriously contemplate attacking through it. Further to the west he held that the frontier with Belgium 'can only be defended from within Belgium.' In this he was probably correct. West of the Ardennes, the Franco-Belgian frontier ran through mostly low-lying, open country with no natural barriers. Furthermore, the large and important industrial area around Lille straddled the border. To build an effective line of fortifications through it would have been prohibitively expensive in land costs alone. Finally, in the 1920s, Belgium was a committed French ally and the most logical defensive strategy was for France and Belgium to jointly defend the line of Belgian fortifications along the Meuse River in eastern Belgium.

Discussions as how best to implement the strategy proposed by Marshal Pétain continued through the first part of the 1920s. By 1927 a general consensus had been reached that France's borders with Germany and with a potentially hostile Italy should be defended by more or less continuous lines of fortifications. The *Commission d'Organisation des Régions Fortifiés* (Commission for the Organisation of Fortified Regions) was established to lay down the basic outline of the works required and oversee their construction. The commission, presided over by General Belhague, the Inspector-General of Engineers, was universally referred to by its initials, CORF. Initial financing was arranged and actual construction began in 1928 both in north-eastern France and in the Alps.

It was at this point that André Maginot entered the picture. He was a hero of World War I who was immensely popular for his work as Minister of Pensions in the 1920s, securing pensions for veterans and compensation for victims of the war. In 1929 he became Minister of War and threw all his formidable abilities into the fortifications project and into obtaining the funding necessary to see it through to completion. In this he was successful, winning over the right with arguments of patriotism and the left with arguments that the project would create employment during a time of deep economic crisis. He was so successful in fact that by 1935, a few years after his death, the press had begun to refer to the fortifications as the 'Maginot Line' (*La Ligne Maginot*) and in August of that year, the term was officially adopted.

Construction

Construction of the fortifications, carried out by a large number of civilian construction firms under contract to the French government, was an immense project comprising 100km of tunnels, 12 million cubic metres of earthworks, 1.5 million cubic metres of concrete, 150,000 tons of steel, and 450km of roads and railways. Work continued throughout the first half of the 1930s and by 1935 construction was largely complete except for some small extensions added to the project in 1934. As in almost any major government project, there were cost overruns and design changes as the project went along. The net result was that some features were eliminated including an entire second cycle that would have greatly strengthened the works built during the initial cycle. But the final cost of over 5,000,000,000 Francs was still close to twice the amount originally budgeted in 1929. On 1 January 1936, CORF was officially dissolved. France continued to build border fortifications right up until the German invasion of France in June 1940, but none of the works constructed were on the scale of those built during the Maginot Line programme.



A section of the anti-tank obstacles surrounding the combat block area of the *gros ouvrage* of Four à Chaux. It consists of lengths of lengths of old railway rails set in concrete Most other areas of anti-tank rails have long since disappeared. Two of the *ouvrage's cloches* are visible in the background. (Author's photograph)

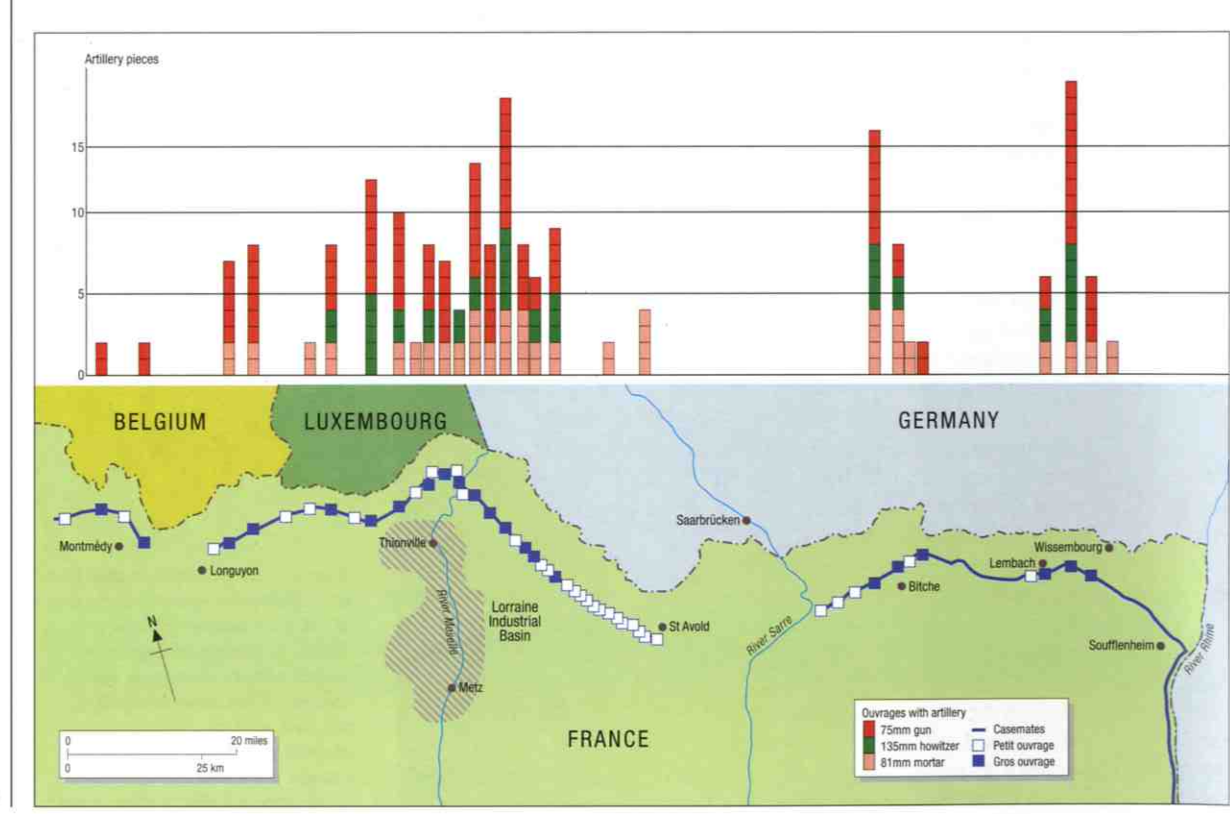
The structure of the Maginot Line

The final scheme implemented under CORF's guidance was to protect France's most vulnerable borders with a thin, tough skin of fortifications backed by strong local reserves of fortress infantry and artillery units operating outside the fortifications. A line of fortifications was to be built along France's northern border from the town of Longuyon, approximately 50km north-west of Metz, to the Rhine River and then down the Rhine River valley to the Swiss border. Along the mountainous northern portion of France's border with Italy the major passes were to be protected by fortifications while to the south where the terrain was less rugged a nearly continuous line would be constructed. The fortifications were to be built from a series of standard components that could be adapted and combined together as needed to form individual works which in turn could be combined to form defensive lines and positions.

North-eastern France

The terrain along the Franco–German border varies from gently rolling ground to fairly hilly country, but it is generally passable by at least infantry along its entire length. Because an attack was possible at almost any point, a continuous line of defences was built along most of the border. It is this section of the Maginot Line programme fortifications that is commonly thought of as being the 'The Maginot Line'.

The defences in this area consisted of an almost uninterrupted line of anti-tank obstacles and barbed-wire entanglements flanked by strong, mutually supporting, reinforced-concrete bunkers (known as interval casemates) armed with machine guns and anti-tank guns. The intervals between the casemates varied from a few hundred metres to a kilometre or more, depending on the terrain. The line of interval casemates was strengthened at irregular intervals with stronger defensive works, the underground forts, called *ouvrages*, for which the Maginot Line was so famous and in which all of the artillery integral to the Line was mounted. Like the interval casemates, the *ouvrages* (literally 'works') were mutually supporting.



The distribution of Maginot Line *ouvrages* and artillery in north-eastern France, based on the author's research. Each vertical bar shows the artillery armament of the *ouvrage* located directly below it on the map. The only exception is that the 81mm mortars represented by the easternmost bar were mounted in an interval casemate.

The line of fortifications ran roughly parallel to France's northern border from a point near Longuyon to the Rhine River. A gap of just over 40km was left in the line astride the Sarre River south of the Saarland, the industrial border area of Germany around the city of Saarbrücken. There seem to have been several reasons why this gap, which came to be known as the Sarre Gap, was created. First, the area was low lying and had a high water table that made it unsuitable for the construction of *ouvrages*. Second, the Saarland was occupied by France under a provision of the Treaty of Versailles that followed World War I, and France would continue to occupy it at least until the results of a plebiscite that was to be held in 1935 were revealed. Finally, the Saarland was the only German industrial area located near the French border: should the plebiscite result in it reverting to German control and should hostilities break out between France and Germany, the Sarre Gap area was where the French Army was likely to mass for a possible offensive against Germany.

The fortifications were organised into two fortified regions, the Metz Fortified Region covering the area from Longuyon to the Sarre Gap and the Lauter Fortified Region covering the area from the Sarre Gap to the Rhine River, each of which was further divided into fortified sectors and subsectors.

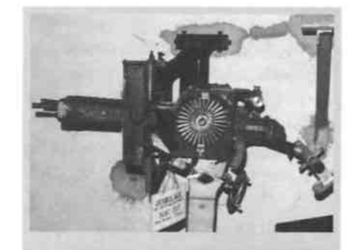
The line was located 5–10km from the border. This made it possible to accurately survey likely artillery targets before the outbreak of hostilities and provided time for the garrisons to achieve full combat readiness in the unlikely event of an enemy surprise attack. Wherever possible the line followed low ridge lines. The interval casemates were situated in locations which provided optimum fields of fire and observation. The *ouvrages* were often situated on hilltops.

The interval casemates

The interval casemates (in French, commonly *casemates d'intervalles*, but properly *casemates de mitrailleuses isolées* – isolated machine gun casemates) were all based on a series of standard plans modified to meet local site requirements. They were two-storey (ground floor and basement) reinforced-concrete structures approximately 15–20m on a side. Each had a garrison consisting of a lieutenant and up to 30 enlisted men.

They were classified as either single or double casemates depending on the number of firing chambers they had (one or two). Firing chambers were located on the upper floor and were oriented to fire to the flank along the line of anti-tank obstacles, not to the front towards an attacking enemy. Orientating the casemates to fire to the flank minimised the exposure of firing embrasures to direct enemy fire while allowing the casemates to hit the enemy in the flank at the point at which he was most vulnerable. In the case of double casemates, the two firing chambers were oriented to fire in opposite directions. Where the terrain did not permit double casemates to be employed, a pair of casemates, each firing in opposite directions, was often used to accomplish the same effect. Occasionally, the casemates of a pair were connected together by an underground gallery.

The firing chamber(s) of an interval casemate generally had two armoured firing embrasures: one for a so-called twin machine gun (*jumelage de mitrailleuses*), a mounting holding two drum-fed 7.5mm machine guns side by side, and one that could be used interchangeably for either a second twin machine gun mounting or for a 37mm or 47mm anti-tank gun. In the latter embrasure, the twin machine gun was mounted on a hinged mount that could



The twin machine gun

The twin machine gun (*jumelage de mitrailleuses*) consists of two drum-fed, 7.5mm machine guns mounted side by side in a single mounting. The drum magazine of each holds 150 rounds resulting in each gun having a maximum sustained rate of fire of approximately 150 rounds per minute. The maximum effective range is approximately 1,200m.

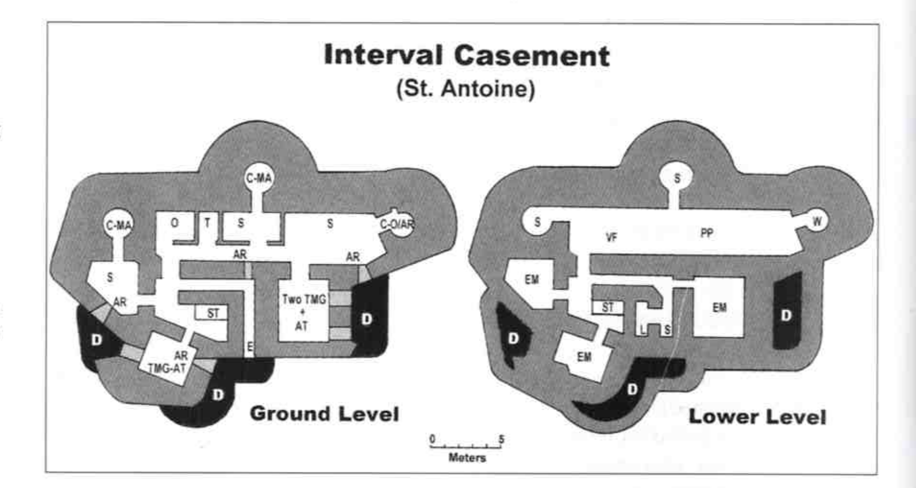
Of the slightly more than 2,000 twin machine guns employed in the Maginot Line, approximately 85 per cent were mounted in casemates: the remainder were mounted in purpose-built twin machine gun *cloches* and in mixed arms turrets.

The photo shows a twin machine gun mounted in the type of swing-out mounting employed in infantry casemates. The cover of the magazine has been removed to expose the cartridges. This particular example has been moved to the museum of the *gros ouvrage* of Hackenberg. (Author's photograph)

Ouvrages and other structures					
Region	***Gros ouvrages***	***Petits ouvrages***	**Interval casemates**	**Observation posts**	**Troop shelters**
Valenciennes/Maubeuge		5	34		
Montmédy Bridgehead	2	2	12		
Metz Fortified Region	14	24	79[1]	11	33
Lauter Fortified Region	6	5	118[2]	2	25
Rhine River			96[3]		8
Alps	22	22	2[1]	4	10
Corsica			19[4]		5
Total	44	58	360	17	81

[1] Includes 1 blockhouse.
[2] Includes 17 blockhouses.
[3] Includes 46 river bank casemates. One source classifies a few of these as shelters.
[4] Includes 3 artillery casemates and 2 blockhouses.

ABOVE This table summarises the fortification-related structures constructed under the auspices of CORF, including those of the new fronts. A large number of supporting structures were also built.

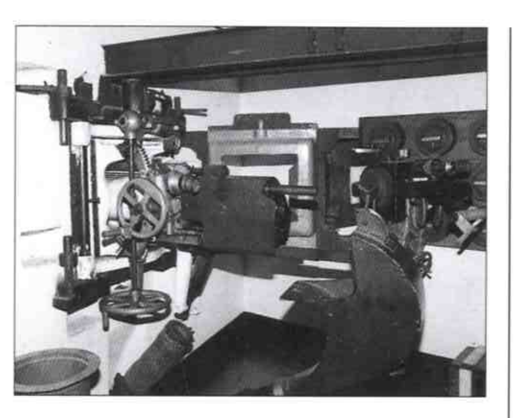


RIGHT An example of a double interval casemate that illustrates how the standard double casemate design with symmetric firing chambers could be adapted to meet local terrain conditions. For a key to the abbreviations used in this and the other plans that follow, see page 2. (Eric Halter/John Richards)

be swung out of the way to allow the anti-tank gun, mounted on an overhead rail, to be slid forward and secured into the embrasure.

Walls facing the probable direction of attack and roofs were constructed of reinforced concrete 2–2.25m thick in order to withstand bombardment from artillery of up to 240mm. Outer walls not subject to direct bombardment were one metre thick. The concrete used to construct all the Maginot Line fortifications was strengthened with an exceptionally dense network of steel reinforcing bars. As a result, it was unusually strong. Additional protection from direct artillery and anti-tank gunfire was provided by building the interval casemates into the sides of hills or artificial mounds of earth, so that no concrete was visible from the primary direction of attack. The firing embrasures were protected from plunging artillery fire by a roof overhang.

External walls that were not shielded by earth were protected by ditches approximately 2m wide and 3m deep. These ditches served two purposes: they prevented the enemy from attacking embrasures and doors with explosive charges and provided somewhere for concrete chipped off walls by bombardment to go so that it did not pile up and block the embrasures. The ditches were flanked by embrasures for 7.5mm automatic rifles (*fusils mitrailleurs*) for close-in defence. Additionally, special launchers were installed to allow hand grenades to be dropped directly into the ditches.



An M1934 47mm anti-tank gun in its firing position in the ammunition and supplies entrance block of the *gros ouvrage* of Schoenenbourg. Spent cartridges eject directly into the chute behind the gun from which they drop into the block's ditch. Beyond the gun is the twin machine gun mounting that has been swung out of the way to make room for the anti-tank gun. On the rear wall are twin machine gun magazines. (Marc Halter)

An interval casemate was entered through an armoured door in its rear. The door was reached by a removable bridge, which spanned the casemate's ditch. The entrance was defended by one or two embrasures for automatic rifles: one flanking the entrance and sometimes a second inside the door, positioned to fire through the doorway when the door was open.

All-around observation and defence was provided by from one to three steel *cloches* installed on the roof of each interval casemate. Externally the *cloches* (literally 'bells') resembled flattened domes. They were the only portions of the casemates that could be seen from the front by an advancing enemy. Several types were employed. They were typically 1.5–2m in diameter and extended about a metre above the roof of the casemate. They were of cast, armoured steel 25–30cm thick. The most common type, the observation and automatic rifle *cloche*, had from three to six embrasures fitted with thick glass vision blocks. These could be removed and replaced by an automatic rifle or a 50mm breech-loading mortar when necessary. Other types of *cloches* were armed with twin machine guns and in some cases a 25mm anti-tank gun mounted between two machine guns in a single mount, the so-called *armes mixtes* (literally 'mixed arms'). A small number of interval casemates were armed only with *cloches*.

Interval casemates were encircled by a low barbed-wire entanglement and were usually further protected on the forward side by anti-tank obstacles. Additional anti-tank obstacles and barbed-wire entanglements joined each interval casemate in the line. The anti-tank obstacles normally consisted of several rows of steel rails set vertically in concrete, but in a few places anti-tank ditches were employed.

Illumination of the areas between the interval casemates was provided by an armoured searchlight mounted on a pedestal in the rear of each casemate and oriented to illuminate the area defended by the casemate's weapons. They could be operated remotely from inside the casemate. Installation of the searchlights had not been completed prior to the outbreak of World War II.

Each interval casemate was provided with everything necessary to make it self-sustaining for a considerable period of time including living accommodation (albeit very cramped), food, a water supply, and a generator for electric power.

As a direct result of the experiences of World War I, great care was taken to ensure that the casemates could continue to function in a battlefield contaminated by poison gas. To this end, exterior openings were sealed to the maximum extent possible, casemate entrance doors were provided with an airlock, and the casemates were provided with a sophisticated air filtration system. This system drew air from outside the casemate, filtered it, and fed it into the casemate at a pressure higher than the outside air pressure. The resulting overpressure inside the casemate prevented poison gases from entering through embrasures and other openings and helped to keep the firing

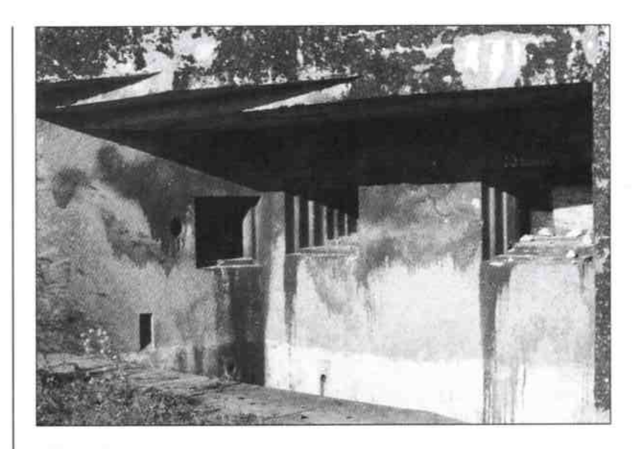
This table summarises the standard thicknesses of reinforced concrete used in the construction of the Maginot Line fortifications and the heaviest artillery against which each was designed to protect. Usage varied widely depending on local site considerations, particularly the degree to which a structure was likely to be exposed to hostile fire and the likelihood that heavy artillery could be brought to bear on it.

Concrete						
Protection standard	**Protects against**	**Thickness in metres**				**Typical uses**
		Roofs	**Exposed walls**	**Non-exposed walls**	**Floors**	
4	420mm	3.5	3.5	1.3	1–1.25	*Gros ouvrage* combat blocks in the north-east, turret blocks in the Alps.
3	300mm	2.5	2.5	1–1.3	1–1.25	*Petit ouvrage* combat blocks, observation posts, shelters, *gros ouvrage* combat blocks in the Alps.
2	240mm	2	2.25	1	1–1.25	Interval casemates
1	150mm	1.5	1.7	1	0.5	Blockhouses, Rhine River casemates.



***Gros Ouvrage* of Fermont, Metz Fortified Region**

The *gros ouvrage* of Fermont, shown here in cutaway, is one of the self-sufficient underground forts for which the Maginot Line is so famous. The *ouvrage* is located a few kilometres east of the town of Longuyon. It is part of the Arrancy subsector of the Metz Fortified Region and came under heavy German attack in June 1940. Fermont is an average-sized *gros ouvrage* that measures some 900m from the centre of its combat block area on the left to its entrance blocks at the right. It had a garrison of 19 officers and 553 enlisted men. Its 75mm gun and 81mm mortar turrets provide all-around artillery fire while the three casemate-mounted 75mm guns of Block 4 fire to the east along the line of fortifications. They provide support for the next *ouvrage* in the line, the *gros ouvrage* of Latiremont, located six kilometres to the east. Block 4, an infantry casemate block, is armed with machine guns and an anti-tank gun. It defends a portion of the line of anti-tank and barbed-wire obstacles that connect the *ouvrages* together. The similarly armed Bois de Beuveille interval casemate defends the next section of obstacles.





ABOVE LEFT The two primary firing embrasures of the interval casemate of Grand Lot. To the left is the smaller embrasure for an automatic rifle protecting the casemate's ditch. The weapons have been removed and embrasures have been boarded up. (Author's photograph)

ABOVE RIGHT A rear view of a double interval casemate near the *gros ouvrage* of Hackenberg. On the left is one of the two firing chambers. The other is on the opposite side of the casemate. At the extreme left is the artificial mound screening the front of the casemate. The casemate's entrance is to the right. (Author's photograph)

chambers free of the suffocating fumes produced when the weapons were fired. Fumes were further reduced by provisions to move spent cartridges out of the casemates as quickly as possible. This was accomplished by attaching a flexible tube to each weapon in such a way that spent cartridges were ejected directly into the tube, which in turn dumped them through a small opening in the casemate's exterior wall into the ditch in front of the weapon's embrasure.

The *ouvrages*

The *ouvrages* that strengthened the line of interval casemates varied greatly in strength from works consisting of not much more than enlarged interval casemates to elaborate combinations of surface combat blocks and subterranean supporting facilities with garrisons of more than 1,000 men. The *ouvrages* were classified in a variety of ways, but the most common classification divides them into two groups: *petits ouvrages* and *gros ouvrages* (literally 'small works' and 'large works'). The terms imply a division by size and indeed *petits ouvrages* were considerably smaller and had smaller garrisons than *gros ouvrages*, but there was another important distinction: *petits ouvrages* generally mounted only infantry-type weapons, such as anti-tank guns and machine guns, while *gros ouvrages* mounted both infantry and artillery weapons. There were 31 *petits ouvrages* and 22 *gros ouvrages* in north-eastern France.

Like the interval casemates, the *ouvrages* were constructed from standardised components combined and modified as necessary to meet local site requirements. In the case of the *ouvrages*, the components were the surface combat blocks in which the *ouvrage*'s weapons were mounted and the various interconnected surface and subterranean works that supported the combat blocks. The number, type and distribution of combat blocks varied widely from *ouvrage* to *ouvrage*, especially among the *gros ouvrages*. Supporting works existed in proportion to the combat blocks. No two *ouvrages* were identical.

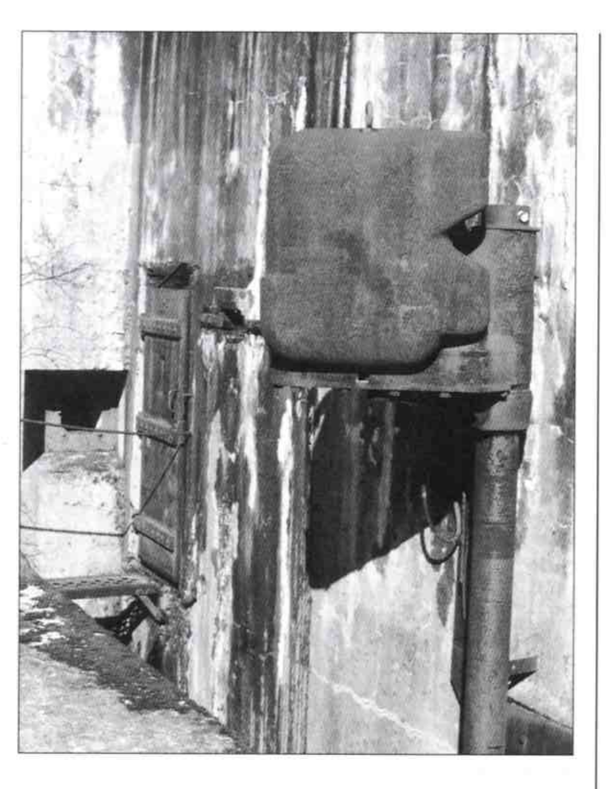
The surface portions of the *ouvrages* were constructed of reinforced concrete that was generally thicker even than that used in the interval casemates. Roofs and exposed walls were generally 2.5m thick in *petits ouvrages* and 3.5m thick in *gros ouvrages*. The latter were intended be able to withstand sustained bombardment from 420mm siege guns like those that were employed against the Verdun forts in World War I.

Like the interval casemates, *ouvrage* blocks were equipped with *cloches* for all-around observation and close-in defence. In addition to the types of *cloches* employed in the interval casemates, there were other types whose usage was largely limited to the *ouvrages*. These included artillery observation *cloches* and the so-called *lance-grenade* (literally 'grenade thrower') *cloche*. The *lance-grenade cloche* differed from most other *cloches* in that its top was flush with the roof of the block in which it was installed. It was intended to mount a 50mm or 60mm breech-loading mortar firing through an embrasure in the roof of the

cloche that would provide additional close-in defence for the block. Technical problems developing the weapons meant that none of the *cloches* were ever armed. (The artillery observation *cloches* are discussed in the Observation Block section on page 25.)

The *petits ouvrages*

A typical *petit ouvrage* consisted of three interconnected combat blocks: two infantry casemate blocks and an infantry turret block. The infantry casemate blocks were very similar to single (one firing chamber) interval casemates. Each had a firing chamber with two armoured embrasures, one for a twin machine gun and one for use interchangeably by a twin machine gun or an anti-tank gun. Each block was also provided with a number of *cloches* for observation and close-in defence.



The rear of the interval casemate of Veckring North. In the background is the embrasure for the automatic rifle protecting the casemate's entrance and the entrance itself. In the foreground is the casemate's armoured searchlight. (Author's photograph)

The infantry turret block was a monolithic, reinforced-concrete structure of roughly the same size as an infantry casemate block. It was sunk completely into the ground. The only portion of the block that was exposed was its flat roof, which was flush with the surface of the surrounding terrain. The principal weapons of the block were mounted in a revolving and retracting turret. The turret was a cylinder approximately 2m in diameter with a low, domed roof. Both the roof and walls were of 30cm-thick cast steel armour.

The turret was set within a domed armoured shield. The shield was buried in the concrete of the block so that its top was nearly flush with the top of the block. When the turret was in its lowered position, the roof of the turret and the shield together formed an almost continuous dome. The turret's weapons fired through embrasures in the face of the turret. These were fully protected by the turret's shield when the turret was in its lowered position. Most of the infantry turrets were machine gun turrets mounting a twin 7.5mm machine gun similar to that mounted in the casemate blocks, but a number were classified as mixed arms (*armes mixtes*) turrets, which comprised two principal types. The first type was a purpose-built turret mounting a single 25mm anti-tank gun between two 7.5mm machine guns, each with its own firing embrasure. These turrets also had a short-range, breech-loading 50mm mortar. The second type was converted from 75mm artillery turrets taken from pre-World War I French forts. The turret's two 75mm guns were removed and replaced by a pair of the same *armes mixtes* employed in some *cloches*.

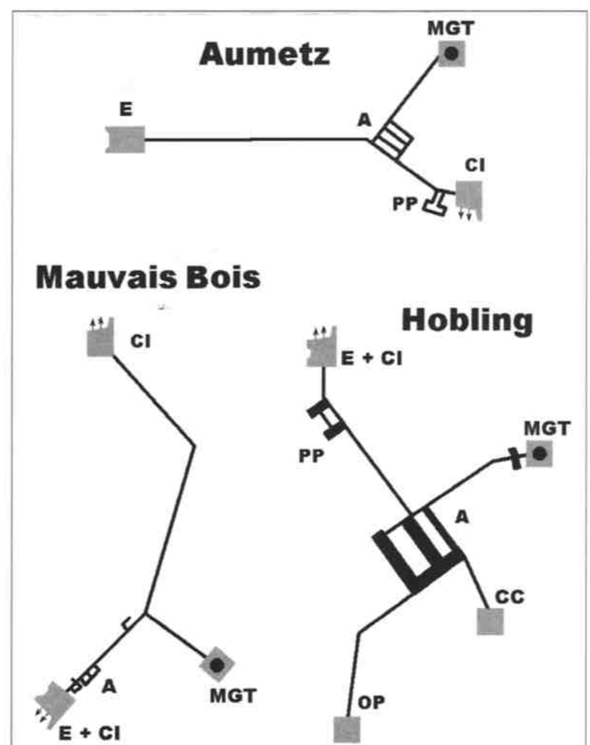
The main portion of the body of the turret was encased in the 2.5m-thick roof of the turret block, but its trunk extended downward to the lower level of the block. The trunk rotated with the turret. The turret's primary fire control position was attached to the turret trunk at the lower level and rotated with it. Sighting was through a periscope whose view port was located either between or adjacent to the weapons embrasures in the face of the turret. The lower level of the block also contained the mechanisms for raising and lowering the turret (a lever and counterweight system) and rotating it; magazines; air filtration equipment; and all of the other equipment necessary to the functioning of the turret. In addition to its turret, each turret block was generally provided with one or two *cloches* for observation and close-in defence. Unlike the casemate blocks, there was usually no direct exit from a turret block to the surface of the *ouvrage*.

The combat blocks were connected together by underground galleries. The gallery level was reached via staircases running down vertical shafts from each block. At the gallery level living accommodation, kitchens, power

RIGHT The machine gun turret of block 8 of the *gros ouvrage* of Rochonvillers in its lowered position. A few of the stakes that supported the barbed wire entanglement surrounding the combat block area can be seen in the background. The entanglement was set in an artificial depression to protect it from hostile fire and to avoid screening the fire of the turret. (Author's photograph)



BELOW Plans of three *petits ouvrages* in north-eastern France illustrating how various more or less standard blocks could be combined to meet local site requirements. (Eric Halter)





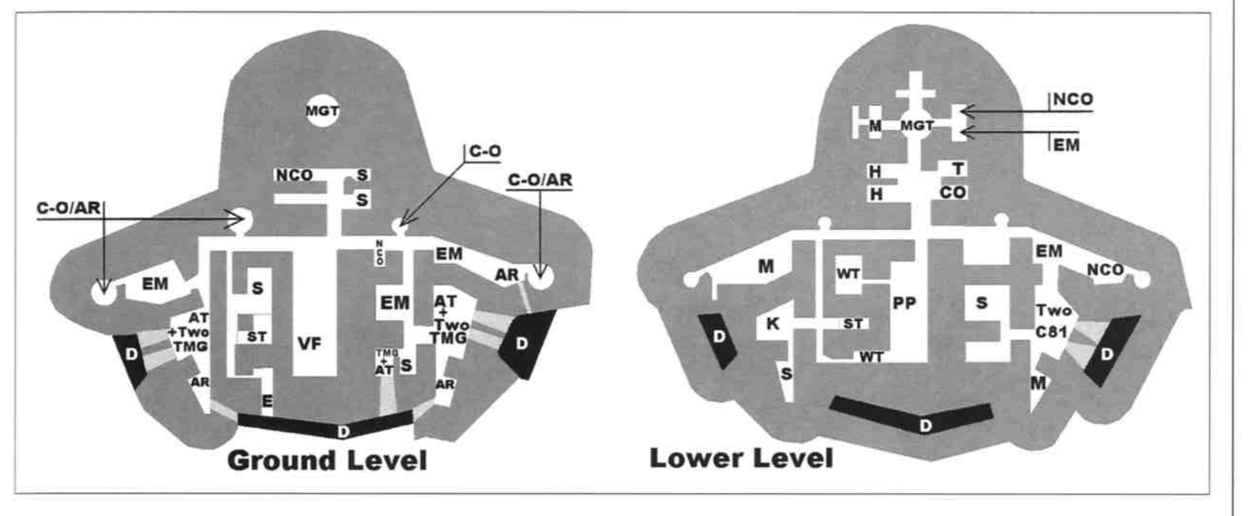
ABOVE RIGHT An M24/29 7.5mm automatic rifle, in this case mounted in the *gros ouvrage* of Schoenenbourg, but the same mounting was used in the interval casemates. The weapon's box magazine holds 20 rounds. The tube below the gun carries spent cartridges to the block's ditch. Visible behind the gun is a launcher for dropping grenades into the ditch. (Marc Halter)

plants, and all of the other facilities necessary to allow the *ouvrage* to function isolated from the outside world for a month or more were constructed. In order to ensure that the underground portions of the *ouvrage* were immune from damage by enemy fire and to allow the garrison to rest in an area as isolated as possible from the stress of the battlefield, the underground portions of the *ouvrage* were normally located at least 20 and often 30 or more metres below the *ouvrage*'s surface.

The three blocks of a typical *petit ouvrage* were generally laid out in triangular form with an infantry casemate block oriented to fire to each flank along the line of anti-tank obstacles that connected the interval casemates and the *ouvrages*. The turret block was usually located between the two casemate blocks and somewhat forward of them. The intervals between the various blocks varied according to the site, but were generally in the 50–150m range. The entire ensemble was surrounded by anti-tank rails and barbed wire. A few *petits ouvrages* were provided with separate entrance blocks located







Plan of the *ouvrage* of Bois du Four, an example of a monolithic *petit ouvrage* in which the armament of two infantry casemate blocks and a machine gun turret block are combined into a single structure. It is one of a small number of *petits ouvrages* that was also armed with a pair of 81mm mortars. The left-hand photo above the plan shows the front of the work behind its artificial mound of earth. The *ouvrage*'s *cloches* are visible on the skyline. Barely visible to the left of the *cloches* and at a lower level is the *ouvrage*'s machine gun turret in the lowered position. The right-hand photo shows the work from the rear. (Eric Halter/author's photographs)

in covered areas in the rear of the *ouvrage*, but more typically entrance to the *ouvrage* was through one of the infantry casemate blocks, with the other casemate block providing an emergency exit.

In a number of cases where the terrain permitted, the functions of two or even three combat blocks were combined into one large monolithic block with one or two firing chambers for twin machine guns and anti-tank guns and an infantry turret. This combining of blocks resulted in several *petits ouvrages* having only a single combat block. In this case, a gallery level was generally not constructed, all living accommodation and support facilities being located in the block itself.

While *petits ouvrages* with three combat blocks or their equivalent were typical, there were numerous variations to meet local site requirements. One of the most common variations was the addition of a combat block similar to an infantry turret block but equipped only with *cloches*. Such blocks were constructed where necessary to provide observation and fire over areas that were not visible from the other blocks of the *ouvrage*. They also sometimes served as artillery observation posts. Other *petits ouvrages* had one or no infantry casemate blocks, and five were armed with 81mm mortars in addition to their normal armament. The garrisons of the *petits ouvrages* varied widely but typically consisted of two to four officers and 100 to 150 men.

The *gros ouvrages*

The *gros ouvrages* were the strongest of the Maginot Line works and contained virtually all of the artillery permanently mounted in the Line. They were large, complex structures with garrisons of 500–1,000 or more men. Each *ouvrage* consisted of a number of combat blocks grouped together in a relatively small area on the main line of resistance and a support area. The support area was generally located 500–800m to the rear of the combat blocks. The entire support area, with the exception of two blocks that housed the entrances to the *ouvrage*, was located 20 or more metres below ground level. An underground gallery connected the support area to the combat block area.



The 81mm mortar

The breech-loading 81mm mortar employed in the Maginot Line was developed as a relatively low cost fortress artillery weapon that could be mounted both in turrets and in casemates and used in roles where a limited-range artillery weapon could be employed effectively.

It fired standard, fin-stabilised, mortar ammunition at a fixed angle of 45 degrees. Range was controlled by first adjusting the number of propellant charges clipped to the fins of the round, and then adjusting the amount of gas vented from the breech during firing.

This photograph shows one of a pair of casemate-mounted mortars in block 3 of the *gros ouvrage* of L'Agaisen in the Maritime Alps. The two large cylinders above the mortar tube accumulate gas vented from the breech during firing. This gas is then released to the exterior of the block through a flexible tube that would have been connected to a fitting on the short pipe that extends out from below the mortar tube.

The upper of the two hand wheels controls how much gas is vented from the breach. The lower hand wheel controls horizontal traverse of the entire mounting, thus controlling the direction of fire. The total traverse possible is 45 degrees.

To load the mortar, a shell was placed on the loading tray that extends down from mortar breech. The breech block was then manually slid upwards and rotated to the right using the L-shaped handle visible in the photo. This action moved the projectile into the tube and sealed the breech. (Author)

Combat blocks

A variety of combat blocks were employed including infantry combat blocks identical to those employed in *petits ouvrages*, artillery turret blocks, artillery casemate blocks, and observation blocks. As in *petits ouvrages*, the functions of combat blocks in the *gros ouvrages* were sometimes combined.

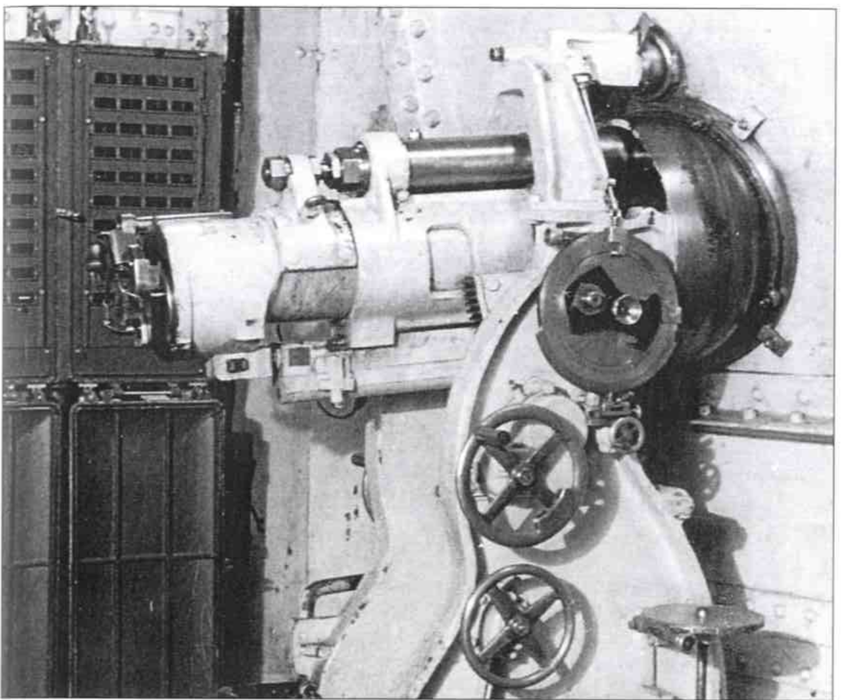
Most *gros ouvrages* had a number of infantry combat blocks, including both infantry casemate and infantry turret blocks. Infantry casemate blocks were often located on one or both flanks of the combat block area, oriented to fire to the flanks of the *ouvrage*. One or two machine-gun or mixed-arms blocks were normally positioned in the forward portion of the combat block area where they could cover likely enemy avenues of approach.

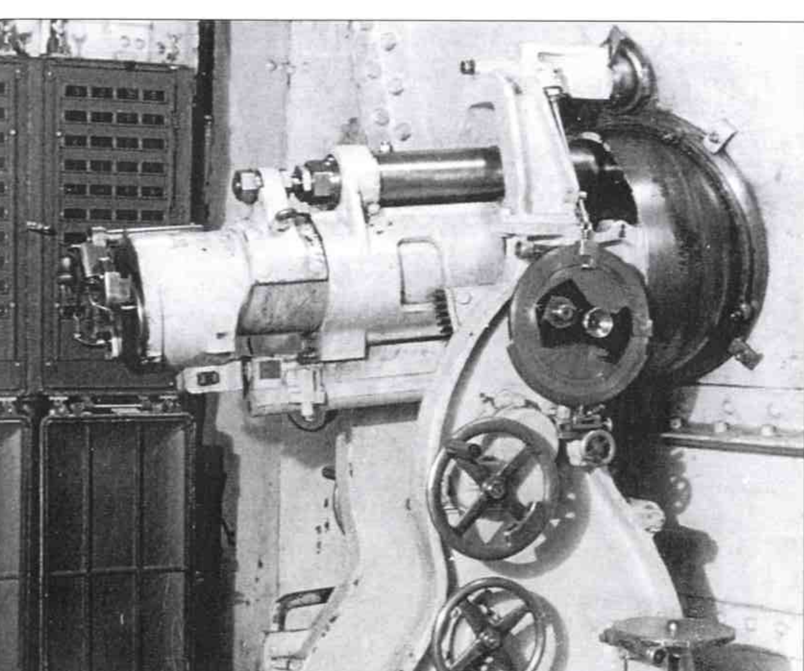
Artillery blocks were two-storey structures and were normally either turret blocks, each with a single artillery turret, or casemate blocks, each with two or three artillery pieces firing through embrasures. The artillery of the *ouvrages* consisted of three principal types of weapon: 81mm breech-loading mortars, 135mm howitzers, and 75mm guns. All were purpose-built fortress artillery pieces and could not be removed from the *ouvrages* for use as field artillery.

The 81mm mortar had a maximum range of 3,200m and was intended primarily for fairly close-in defence of the *ouvrage* itself. It was a breech-loading weapon that fired standard mortar ammunition at a fixed angle of 45 degrees. The 135mm howitzer (*lance-bombe*, literally 'bomb thrower') was a very short-barrelled weapon with a maximum range of 5,700m. Its range limited it to a primarily defensive role. The 75mm gun (*canon-obusier*, literally 'gun-howitzer') was the most important artillery weapon mounted in the *gros ouvrages*. It was very accurate and had a high rate of fire. Several models were employed, but the majority had a maximum range of about 12,000m. The major exception was a short-barrelled model that had a maximum range of only about 9,000m. Technically classified as a howitzer (*obusier*), for convenience it is usually grouped together with the 75mm guns. The greater range of the 75mm gun made it possible to employ it in a more offensive role than was possible for either the 81mm mortar or the 135mm howitzer.

The artillery weapons were mounted either in artillery turrets or in artillery casemates with the majority being in turrets. The artillery turrets resembled enlarged infantry turrets; however, in their raised position they did not project as far above the block's roof as infantry turrets did. The walls and roofs of the artillery turrets were 30–35cm thick. Regardless of the type of artillery weapon, each turret mounted two weapons firing through embrasures in the face of the turret. In order to make it possible for the turret's embrasures to be fully covered by the turret's shield when the turret was in its lowered position, and to minimise the size of the firing embrasures, the 135mm howitzers and 75mm guns were muzzle pivoting. While this served to protect the weapons from hostile fire, it increased the distance through which the breech moved during elevation and depression, which in turn made loading difficult. These problems were not particularly severe for the short-barrelled 135mm howitzer, but were serious in the earlier models of the 75mm gun turrets. The problem was solved in later-model turrets by installing a movable platform for the loaders within the turret. The platform moved up and down automatically as the guns were elevated or depressed. The turret was also fitted with an ingenious ammunition supply system, which delivered ammunition to the loaders at the most convenient height, whatever the height of the loading platform.

Like an infantry turret, the primary fire control position of an artillery turret was attached to the turret's trunk at the upper of the two levels of the block itself. The turret trunk also contained two ammunition hoists, one for each gun. These were serviced from a ready-use magazine, known as the M3 magazine, located on the block's upper level. For a 75mm gun turret, the ready-use magazine held 1,200 rounds of ammunition.





The turret trunk extended to the lower level of the block where the mechanisms for raising, lowering and rotating the turret were located. These mechanisms were electrically powered but manual back-up mechanisms were also provided. The block also contained air filtration equipment and limited crew accommodation. As with other combat blocks, the artillery turret blocks were provided with one or two *cloches* for close in-defence.

Like infantry casemates, artillery casemates were oriented to fire along the main line of resistance, not to the front toward an attacking enemy. While artillery turrets with their 360-degree fields of fire could be employed in both offensive and defensive roles, artillery casemates, with their limited 45-degree fields of fire, were restricted to the role of supporting adjacent Maginot Line works. This support could include firing directly on top of a work should an enemy succeed in reaching the work's surface.

The most common type of artillery casemate block had a firing chamber on its upper level mounting two or three 75mm guns firing through armoured embrasures in one of the block's sides. Such blocks generally also had air filtration equipment, an M3 magazine with 600 rounds of ammunition per gun, and *cloches* for close-in defence.

To minimise the exposure of the concrete of the artillery casemates to direct enemy fire, the blocks were built into the reverse slopes of hills or artificial mounds. Only the face in which the embrasures were located was not covered

75mm guns

The various models of casemate and turret-mounted 75mm guns all derived at least indirectly from the remarkably effective 'French 75' field gun of World War I fame. Because of its range, accuracy and high rate of fire, the 75mm gun had an importance that was disproportionate to the relatively small number of weapons actually employed. Normal rates of fire were 12 rounds per minute but an accelerated rate of fire of 24 rounds per minute was possible for short periods of time.

The photos show interior and exterior views of a casemate-mounted M1929 75mm gun. Like all other weapons mounted in Maginot Line fortifications, the gun pivots around a ball joint located in the weapon's embrasure. This allows the embrasure size to be minimised while still providing the weapon with a reasonable field of fire. The primary weakness of this model was that the projecting barrel was exposed to hostile fire.

The problem was rectified in the 1932 model in which the pivot point was moved closer to the muzzle of the gun. This reduced the amount of the barrel that projected from the embrasure and allowed the embrasure to be fitted with a shield that could be closed to protect the barrel when the gun was not firing. The disadvantage of moving the pivot point forward was that it increased the amount of movement of the breech as the gun was elevated and depressed. To facilitate loading, the M1932 mounting was equipped with a platform for the gunners that automatically moved vertically with the breech of the gun. (Photographs: A. Haas)

Maginot Line artillery pieces

Region	75mm guns[1]		135mm howitzers		81mm mortars		75mm 'mortars'	95mm guns	Total
	Casemate	Turret	Casemate	Turret	Casemate	Turret	Casemate	Casemate	
Montmédy Bridgehead		4							4
Metz Fortified Region	29	40	3	22	14	28			136
Lauter Fortified Region	15	14	4	10	4	14			61
Alps	22	10	2	2	68		30	4	138
Corsica	4								4
Total	70	68	9	34	86	42	30	4	343
Grand total	138		43		128		30	4	343

[1] Includes 33 x 75mm howitzers, 9 mounted in casemates, 24 in turrets, all in north-eastern France.

This table summarises the employment of artillery within the Maginot Line fortifications. There were no artillery pieces mounted in either the Valenciennes/Maubeuge or the Rhine River fortifications. The four 75mm guns in Corsica were mounted in stand-alone artillery casemates.

by earth and it was constructed in such a way that each embrasure was stepped back from its neighbour so that the entire face angled away from the primary direction of attack. As in infantry casemate blocks, ditches were constructed in front of the exposed face of the artillery casemate blocks. Artillery casemate blocks were often provided with an emergency exit in the form of a low doorway that provided access to a removable bridge spanning the block's ditch.

Those 135mm howitzers mounted in casemates were mounted singly in blocks that housed some other armament, often a 135mm turret. The 81mm mortars mounted in casemates were generally mounted in pairs, often at the lower level of an infantry casemate block below the block's normal firing chamber. This allowed the mortars to fire from the concealment of the block's ditch.

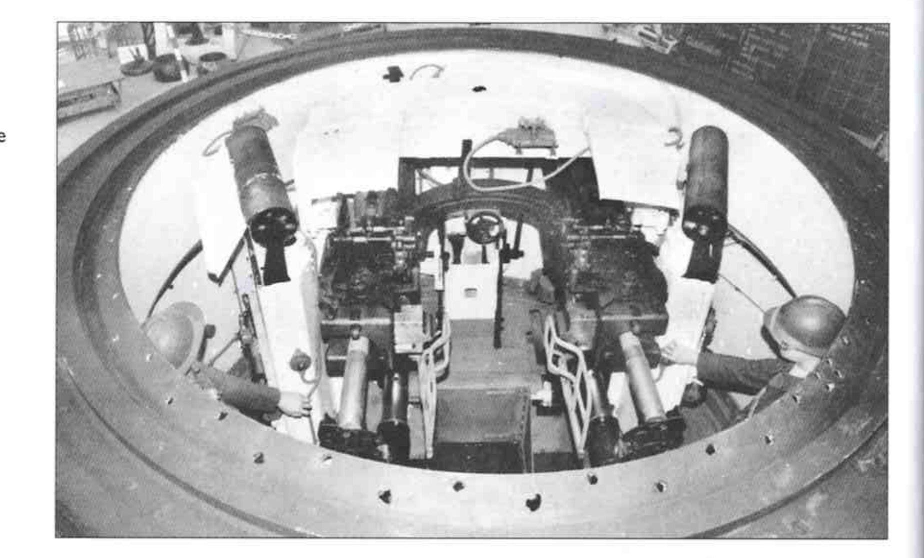
Each artillery block, whether a turret block or a casemate block, was connected by its own vertical shaft to the *ouvrage*'s gallery level. This shaft contained a staircase and two lifts for transporting ammunition from the gallery level to the combat block level. The only interconnection between blocks was at the gallery level. Facilities at the gallery level of each block generally included a large secondary magazine known as the M2 magazine



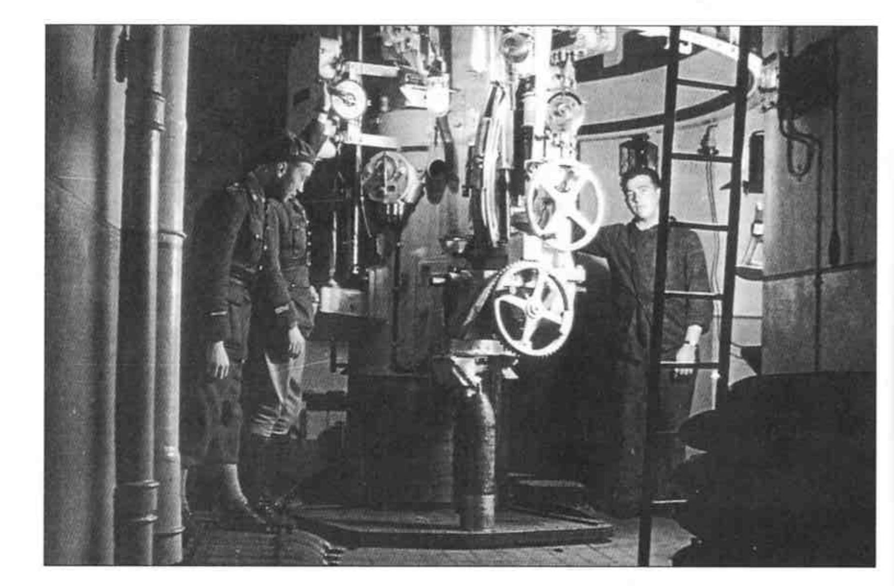
The business end of the 135mm howitzer turret of block 7 of the *gros ouvrage* of Rochonvillers. Note that there are no apertures for sights. All 135mm howitzer turret fire was indirect using elevation and deflection data computed by the block command post. (Author's photograph)

twin machine gun cloche
air intake
observation and automatic rifle cloche
M1933 twin 75mm gun turret
turret shield
turret trunk
order transmitter
turret counterweight
turret elevation mechanism
lift and stairs to gallery level
ventilation and filters
M3 magazine (1,200 75mm rounds)
ammunition cage on overhead rail (50 rounds)
sleeping quarters

A cutaway of a hypothetical M1933 75mm gun turret block. With its 360-degree traverse, long-range accuracy and sustainable high rate of fire, the 75mm gun turrets were the most effective artillery employed in the Maginot Line *ouvrages*. The observation and automatic rifle cloche at the rear of the block provides all-around observation and close-in defence for the block while the twin machine gun cloche at the left aids in the defence of the surface of the *ouvrage* in which the block is located.



An M1933 75mm gun turret in the museum of the *gros ouvrage* of Fermont. The armoured roof has been removed exposing the firing chamber. The ammunition hoists are visible to the outside of each gun. (Hans Vermeulen)



The control position of the 135mm howitzer turret of block 14 of the *gros ouvrage* of Hochwald. The turret trunk is in the elevated position, indicating the turret is in the raised, firing position. The ladder on the right provides access to the turret itself. (A. Haas)

(holding 2,800 rounds per tube in the case of blocks armed with 75mm guns), a block command post, and accommodation for the block commander.

The block command post was responsible for the detailed computations necessary to bring fire to bear on targets designated by the *ouvrage* command post. Fire commands were passed from the block command post to the guns by means of an order transmitter, which was basically an elaborate version of the engine-room telegraph used to pass commands from the bridge to the engine room on a ship.

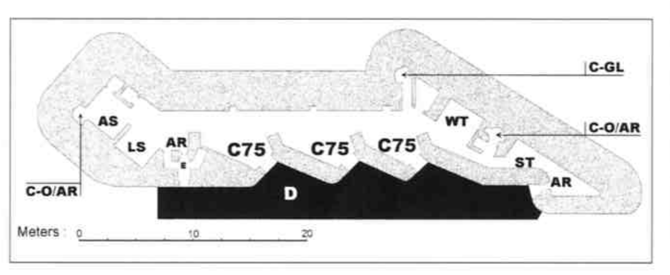
At the gallery level, a single passage connected the combat block to the rest of the *ouvrage*. This passage was provided with an armoured airlock that was normally kept closed. In an emergency, the airlock could be barricaded to physically isolate the combat block and its supporting facilities at the gallery level from the rest of the *ouvrage* or vice versa. As in the interval casemates, the air within the *ouvrages* could be filtered and was maintained at a slight overpressure to keep out poison gases. The exact amount of the overpressure was closely controlled and varied from combat block to combat block depending on the type of weapon mounted. The pressure selected would ensure optimum expulsion of the fumes produced when the weapons fired. Under normal



The block command post of block 14 (135mm howitzer turret) of the *gros ouvrage* of Hochwald. At the right rear of the photo is the order transmitter used for transmitting firing data to the turret crew. (A. Haas)

conditions, the combat blocks drew their air from the galleries of the *ouvrage*, but, in an emergency, each was capable of drawing and filtering air from outside the block itself.

As in the interval casemates and infantry combat blocks, careful provision was made for the rapid evacuation of spent cartridges from the artillery combat blocks. The guns ejected their cartridges directly into chutes that carried the cartridges directly to a special room located at the gallery level below the block. Within the *ouvrage*, artillery ammunition was stored and transported in large metal cages holding 50 or more rounds depending on the ammunition calibre. Hand-operated trolley hoists suspended from overhead rails were used to move the cages both inside the blocks and at the gallery level.



A plan of the upper (ground) level of a typical 75mm gun casemate block in north-eastern France, in this case block 5 of the *gros ouvrage* of Hackenberg. The curved, light grey lines represent the overhead rails used for transporting ammunition cages within the block. The block's three M1929 75mm guns fired along the main line of fortifications. (Eric Halter)

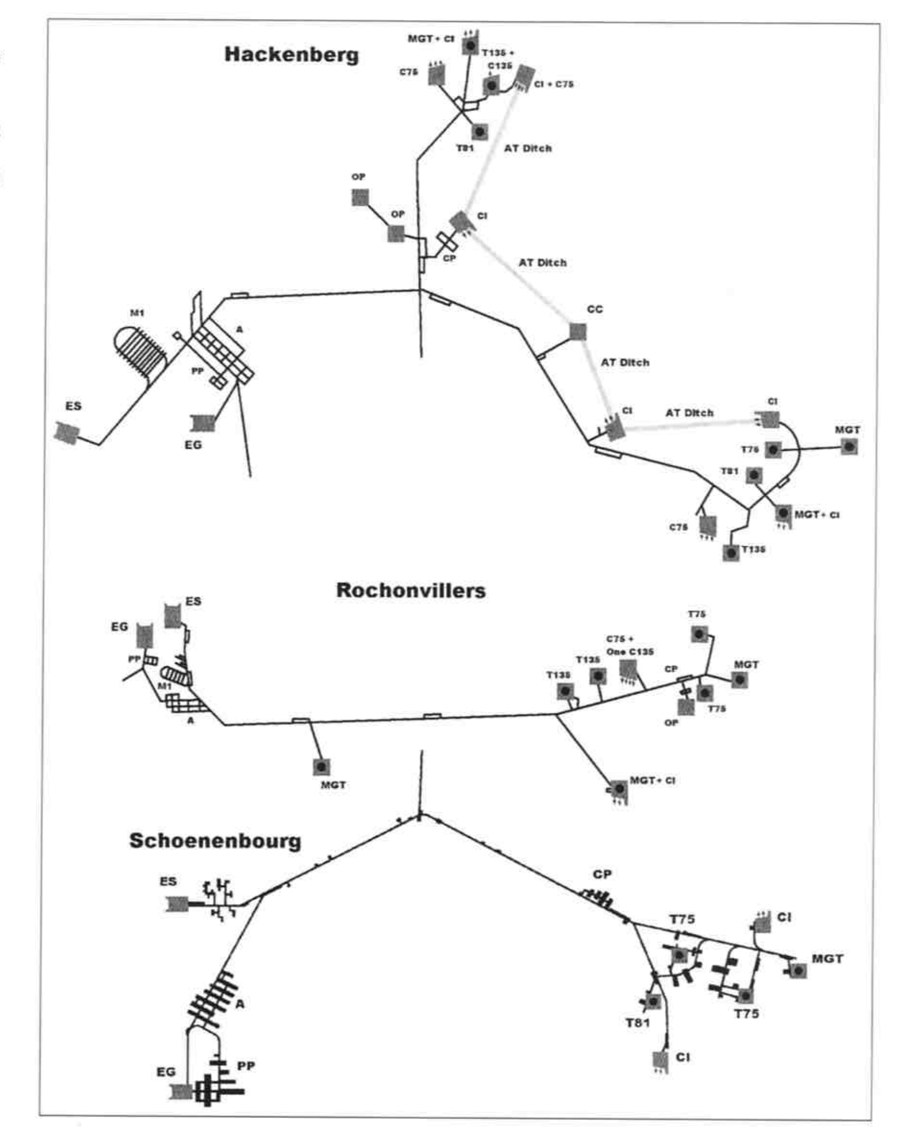
Observation blocks

In addition to its combat blocks, most *gros ouvrages* had one or sometimes two observation blocks. These resembled turret blocks without turrets. Each was equipped with several *cloches* two of which were generally specialised ones for artillery observation and fire control. One was provided with observation slits and a roof mounting that could take various types of relatively low power observation periscopes including a specialised one for night use. The other was flush with the roof of the observation block and mounted a high-powered, retractable periscope similar to those employed on submarines. It was intended for precise target location. The observation blocks were positioned so as to provide the best view possible of likely avenues of approach. In some case this meant that the block was situated outside of the combat block area.

Combat block distribution

The total number of artillery tubes mounted in the *gros ouvrages* of north-eastern France, 189 tubes in 22 *gros ouvrages*, was surprisingly small, averaging some eight and a half tubes per *ouvrage*. The low numbers of weapons was partly offset by the fact that the weapons had very high rates of fire that could be sustained for much longer periods of time than was possible for field artillery weapons. For example, it was felt that a single 75mm gun turret was equal in firepower to two 75mm field artillery batteries.

Examples of *gros ouvrages* in north-eastern France. Hackenberg is generally accepted to be the largest *ouvrage* of all. Rochonvillers is unusual in a number of respects, not the least of which is that one of its machine gun turret blocks is located outside the combat block area. Schoenenbourg is the easternmost of the north-eastern *gros ouvrages*. (Eric Halter)



The size and shape of the combat block area varied greatly depending on the terrain in which the *ouvrage* was located and on the size and number of combat blocks with which it was equipped. For an average-size *ouvrage*, the area was 200–300m wide and about the same deep. The entire area was surrounded by anti-tank obstacles and barbed wire entanglements. In addition, individual blocks within the area were often surrounded by their own barbed-wire entanglements.

The two largest *ouvrages* – Hackenberg, east of Thionville, and Hochwald, south-west of Wissembourg – each had two areas of combat blocks. The two areas at Hackenberg were joined together by an anti-tank wall and ditch that was flanked by infantry blocks integral to the *ouvrage* itself. The two areas at Hochwald (which were on opposite sides of a fairly high ridge) were also connected by an anti-tank ditch, but this was flanked for the most part by blockhouses that were not integral to the *ouvrage*.

The number and type of combat blocks that an *ouvrage* possessed also varied. The *gros ouvrage* of Fermont, north-east of Longuyon, can be considered fairly typical though. It had two machine gun turret blocks, one infantry casemate block, one 81mm mortar turret block, one 75mm gun turret block, a three-gun 75mm gun casemate block, and an observation block. The *gros ouvrage* of

Rochonvillers, north-west of Thionville, was a somewhat more heavily armed work with two machine gun turret blocks, a combined machine gun turret and infantry casemate block, four artillery turret blocks, and an unusual artillery casemate block with one 135mm howitzer and three 75mm guns.

The largest *ouvrage* of all was the *gros ouvrage* of Hackenberg. The northern-most of its two areas of combat blocks had a combined infantry casemate and machine gun turret block, an 81mm mortar turret block, a block with a 135mm howitzer turret and a single casemate-mounted 135mm howitzer, and a three-gun 75mm gun casemate block. The southern combat block area had a machine gun turret block, a combined infantry casemate and machine gun turret block, an 81mm mortar turret block, a 135mm howitzer turret block, a 75mm gun turret block, and a three-gun 75mm gun casemate block. The anti-tank wall and ditch connecting the two combat areas were flanked by five variously armed infantry blocks, one of which also had a single casemate-mounted 75mm howitzer. Two observation blocks were located at the top of a ridge between and in the rear of the two areas of combat blocks.

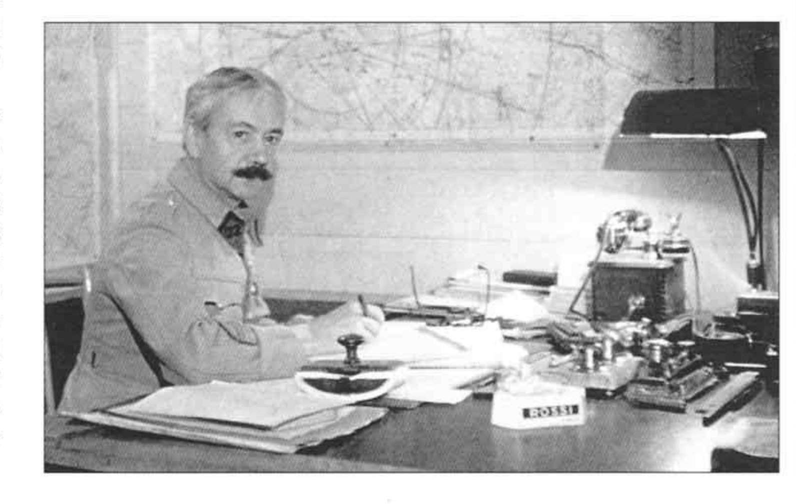
The *ouvrage* command post

The actions of an *ouvrage*'s combat blocks were controlled from the *ouvrage* command post consisting of a series of rooms at the gallery level of the *ouvrage*. The command post was located in the vicinity of the combat blocks, often near the observation block. The *ouvrage* command post consisted of three separate but closely co-ordinated command posts: the *ouvrage* commander's command post, the artillery command post, and the infantry command post. In addition, it contained the *ouvrage*'s central telephone exchange and sleeping quarters for a number of officers whose duties required them to be near the command post at all times.

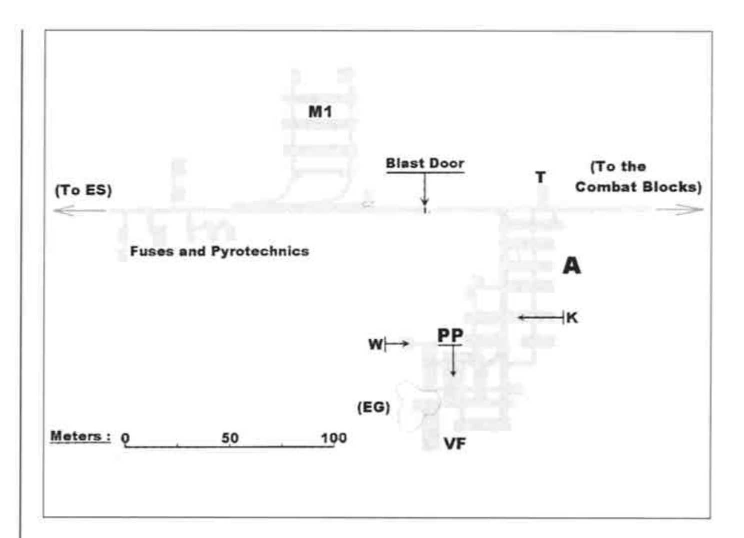
The infantry command post co-ordinated the actions of the *ouvrage*'s infantry blocks as well as the general close-in defence of the *ouvrage*. The artillery command post controlled the artillery fire of the *ouvrage*. It received information about enemy sightings from various sources including the *ouvrage*'s own observation block and decided which of the *ouvrage*'s artillery blocks would engage a target. Once a block was designated to engage a target, it was placed in direct telephone contact with the observer who had reported the target. The *ouvrage* command post then monitored the conduct of the fire that was carried out by direct co-ordination between the firing block's command post and the observer.

Each *ouvrage* was also part of an artillery group. The *ouvrage*'s artillery command post was in direct contact with the group command post. The *ouvrage* command post could pass on targets that it could not engage to the artillery group command post for possible engagement by another *ouvrage* and could receive targets from the group command post.

In order to provide the most secure and reliable communications possible an extensive network of buried phone lines connected all the Maginot Line works together. The telephone network was supplemented by a radio network, but it proved troublesome and unreliable in practice. The antennas were a major problem. They were generally situated on the face of artillery casemate or entrance blocks, but the reception was less than optimal and they could fairly easily be damaged by hostile fire.



Lieutenant-colonel Miconnet, commandant of the *gros ouvrage* of Hochwald, at his office in the *ouvrage*. (A. Haas)



A fairly typical support area for the Soetrich *gros ouvrage* in north-eastern France. The *ouvrage*'s 0.6m gauge electric railway runs along the main gallery. (Eric Halter)

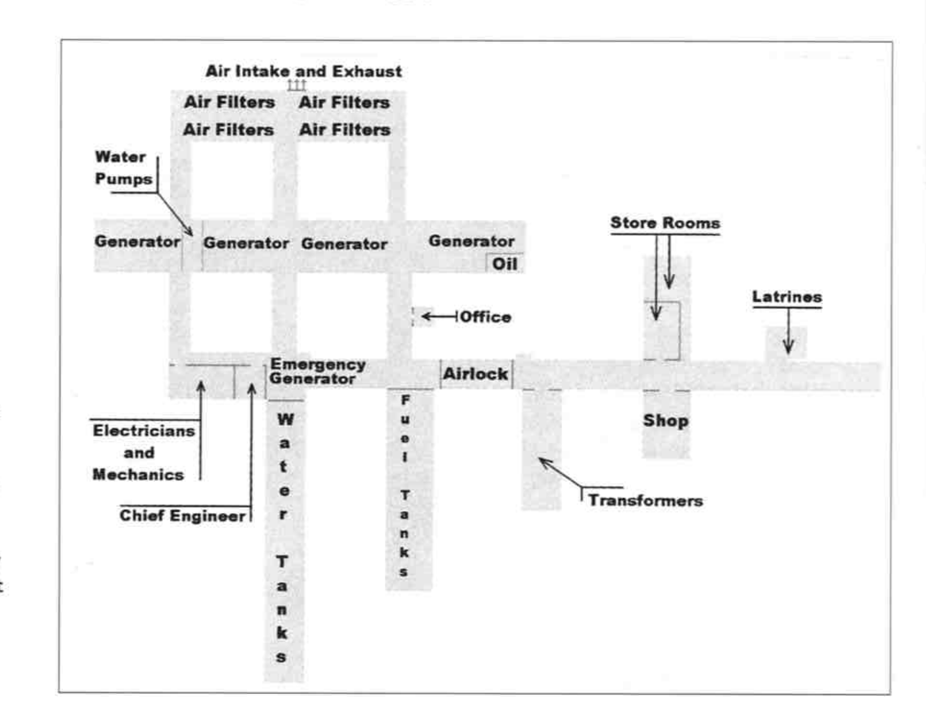
The support area

Where terrain permitted, the support area of an *ouvrage* was located several hundred metres to the rear of the combat block area. The combat block area was connected to the support area by a single gallery. This gallery normally forked near the support area with one fork leading to the accommodation area and the other leading to the *ouvrage*'s main magazine, known as the M1 magazine.

Transportation of ammunition and heavy equipment along the main galleries of the *ouvrage* was by means of a 0.6m-gauge railway. The railway was provided with electric locomotives, except in cases where the terrain made it necessary to locate the support area near the combat blocks. Rail cars were hand-pushed in *ouvrages* without electric locomotives.

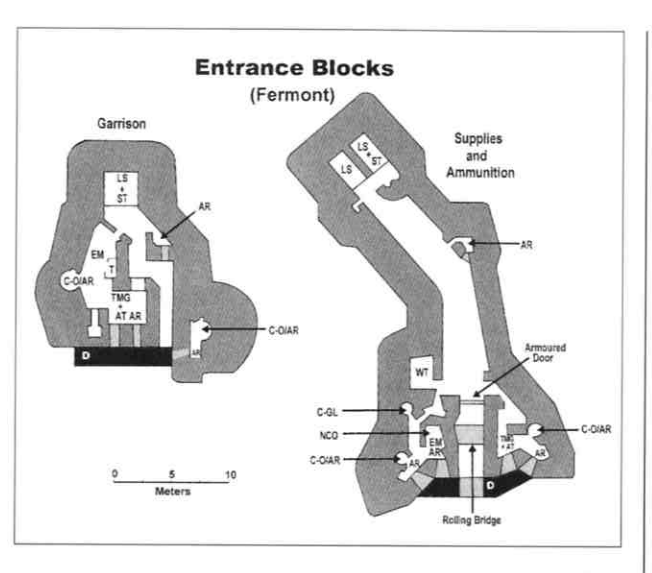
The accommodation area contained barrack rooms, kitchens, latrines, washrooms, storerooms, a hospital, and all of the other facilities necessary to support the *ouvrage*'s garrison. It was provided with its own integral water supply and was stocked with all of the provisions necessary for functioning in complete isolation from the outside world for a month or more. Facilities were far from plush. Enlisted men slept in shifts in barrack rooms that accommodated 24–36 men in tightly packed bunk beds. Food was eaten on small tables that folded down from corridor walls. Virtually no recreation facilities were available. Although electric heating and lighting was provided, the accommodation areas were generally damp and poorly lit.

The support area also contained the main air filtration equipment and the *ouvrage*'s electric power station. An *ouvrage* normally drew its electric power from the French national power grid through buried cables, but it was also provided with up to four large diesel-driven generator sets for use in case of a failure of the external power supply. Sufficient fuel and lubricants were stocked to allow the *ouvrage*'s generators to fill all of the *ouvrage*'s power needs for a month or more. As an additional backup, *ouvrages* were interconnected so that, in an emergency, one *ouvrage* could provide power to another.



The power plant area of the *gros ouvrage* of Schoenenbourg, a medium-sized *gros ouvrage* in north-eastern France. Each of the four diesel-engine-powered generator sets was capable of producing 160 kW of 440 volt, 50 cycle, alternating current. Most electrical equipment within the *ouvrage* operated at 440 volts, but the power plant contained the converters and transformers necessary to produce the 600 volt direct current required by the railway locomotives and the 120 volt direct current required by the turret motors. The power plant could also convert high-voltage current provided by the national power grid to meet the *ouvrage*'s needs. (Eric Halter)

The size of the M1 magazine varied widely depending on the amount of artillery installed in the *ouvrage*. For 75mm guns, it typically held 3,000 rounds per tube. Some of the smaller *gros ouvrages* had no M1 magazine at all. In order to guard against the danger of accidental explosion, the M1 magazine was separated from most of the rest of the facilities in the support area and the gallery that connected it to the rest of the *ouvrage* was fitted with a massive armoured blast door. This door was provided with a semi-automatic, counterweight-based closing system that permitted the door to be closed extremely rapidly in case of a magazine fire or other potential catastrophic emergency.



Ground level plans of typical entrance blocks for a *gros ouvrage* in north-eastern France. In this *ouvrage*, descent to the gallery level is by means of vertical shafts. In the supplies and ammunition entrance block, one shaft is equipped with a 5 tonne lift while the other is equipped with a 2.5 tonne lift and a staircase of 96 steps. The garrison entrance block shaft has a 2.5 tonne lift and staircase of 124 steps. Both blocks have lower levels housing equipment and limited accommodation for the block garrison. (Eric Halter/John Richards)

The extent of the galleries constructed to contain and interconnect the subterranean facilities of an *ouvrage* was impressive. The *gros ouvrage* of Hackenberg, for example, had over 10km of galleries, 3.2km of which were fitted with railway tracks.

Entrance blocks

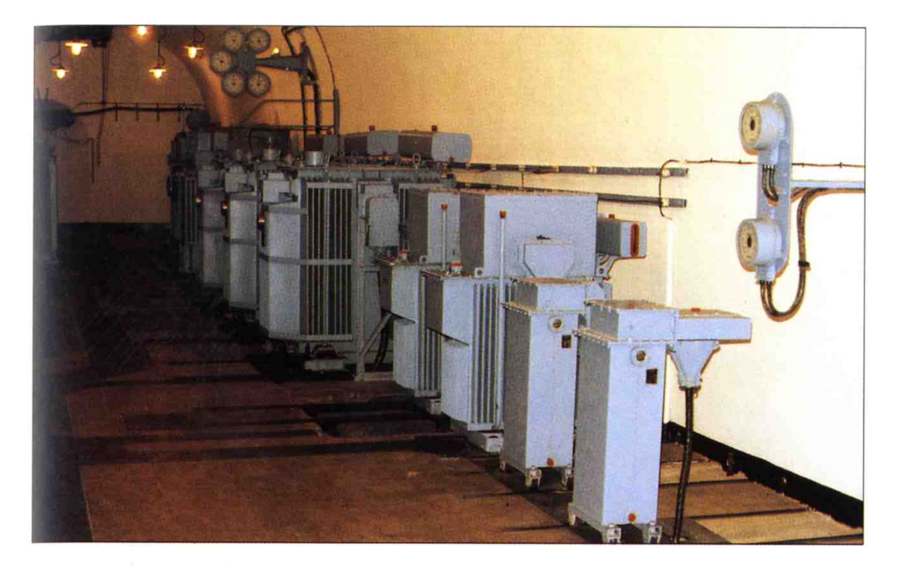
Most *gros ouvrages* had two entrance blocks located close to the support area: one for the garrison (*bloc d'entrée des hommes*), which generally provided direct access to the *ouvrage*'s power station and the principal gallery of the accommodation area, and one for supplies and ammunition (*bloc d'entrée des munitions*), which generally provided direct access to the principal gallery of the *ouvrage* and to the M1 magazine. A number of the smaller *gros ouvrages* had only a single, combination entrance block. The entrance blocks were located a short distance apart in positions that were sheltered from enemy observation and fire and that had covered lines of communication to the rear areas of the army. The entrance blocks were as strongly constructed as combat blocks and had an armament comparable to that of an infantry casemate block. Additional protection was provided by ditches, rolling bridges, armoured doors, and interior blockhouses. In cases where an *ouvrage* was connected to the army's narrow gauge railway system, the ammunition and supplies entrance block had sufficient space to allow an engine and several rail cars to enter. In other cases, the block was large enough to allow two or three army trucks to enter. In either case, the blocks were laid out so that unloading could be done directly onto cars of the *ouvrage*'s railway.

Depending on the terrain, one of three types of connection was provided between an entrance block and the rest of the *ouvrage*. Where an *ouvrage* was built into the side of a high-enough hill, a direct, level connection was provided. In cases where it was necessary for the gallery level of the *ouvrage* to be lower than the entrance blocks, the connection between an entrance block and the rest of the *ouvrage* was by either a vertical shaft or an inclined shaft. Vertical shafts were provided with lifts while inclined shafts were provided with cable railways. Both the lifts and the inclined railways serving the entrance blocks for ammunition and supplies were large enough to accommodate cars of the *ouvrage*'s railway.

Supporting works

In addition to the interval casemates and *ouvrages*, a considerable number of works were built in support of the Maginot Line. These included observation posts, interval troop shelters, electric power substations, and telephone exchanges.

Power generators in the *gros ouvrage* of Hackenberg



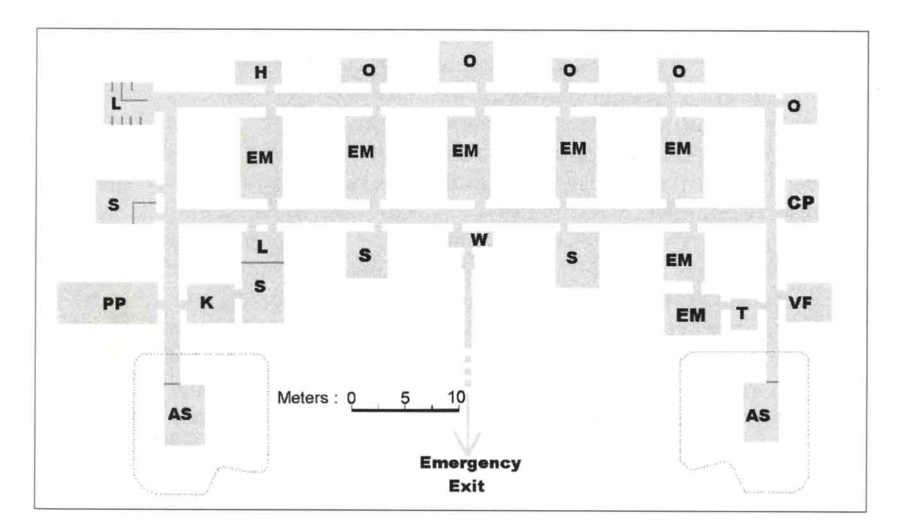
OPPOSITE PAGE A senior non-commissioned officer and lieutenant of engineers discuss the condition of one of the four 230 kW generating sets in the *gros ouvrage* of Hackenberg. The non-commissioned officer is standing on the platform of the 380hp diesel engine that drives the large alternator in the foreground. A second generating set is visible in the background.

LEFT The transformer room in the power plant of the *gros ouvrage* of Hackenberg. It was here that electricity either from the national grid or from the *ouvrage*'s own generator sets was converted to the various voltages required within the *ouvrage*. The room also houses switching equipment and distribution panels. (Author's photograph)

The observation posts were freestanding versions of the observation blocks found in the *ouvrages*. They were constructed near the main line of resistance to provide observation over areas that could not be seen from the *ouvrages'* observation blocks.

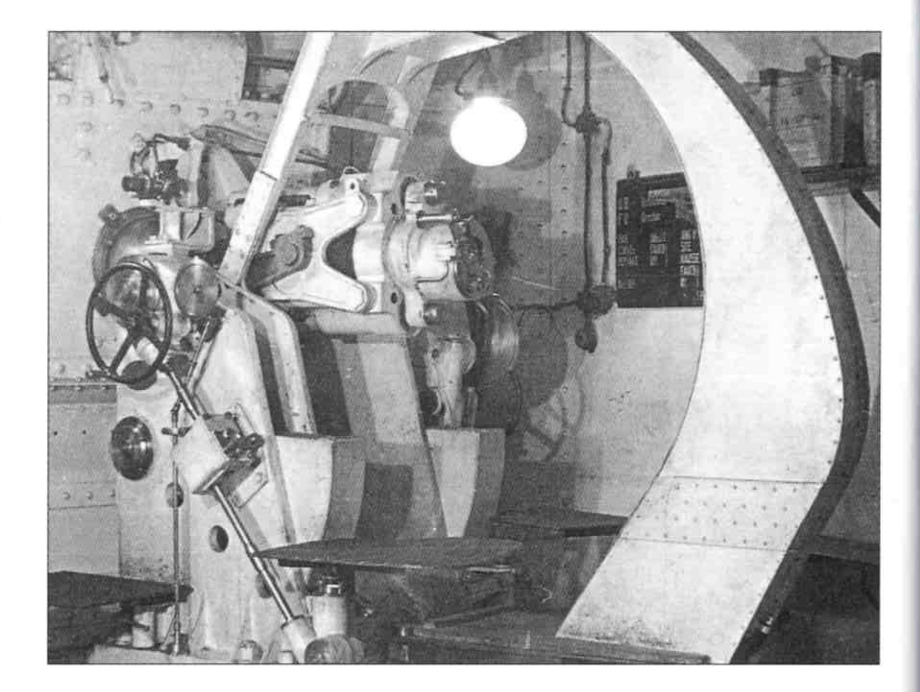
The interval troop shelters (*abris d'intervalle*) were constructed in sheltered positions in the rear of the main line of resistance. They varied in size with a capacity of up to 250 men and were intended to provide shelter for local reserves operating in the open defending the intervals between the casemates and *ouvrages* of the main line of resistance. The troop shelters were of two general types. Both were of the same massive construction used in the interval casemates and the combat blocks of the *ouvrages*. The first type was a large monolithic block constructed on the surface. The second type was completely underground with surface access provided through two small surface blocks. Like other Maginot Line works, interval troop shelters were normally equipped with *cloches* for close-in defence.

Reinforced-concrete electric power substations were constructed in the rear of the line at locations where the underground cables supplying power to *ouvrages* and casemates were connected to the surface power lines of the French national grid. Similar structures were built to house telephone exchanges for the underground network of telephone lines that connected all the works together.



LEFT An example of a subterranean interval troop shelter in north-eastern France, in this case the shelter of Grassersloch. It has a capacity of about 145 officers and men. Each of the two surface entrance blocks is equipped with an observation and automatic rifle *cloche* and an embrasure for an automatic rifle that flanks the entrance door. (Eric Halter)

A relatively rare casemate-mounted M1932-R 75mm howitzer. This example is one of two that defended the anti-tank ditches of the *gros ouvrage* of Hochwald. The large, curved object is the receiver into which spent cartridge cases were ejected. From the receiver, the cartridges fell down a chute into a room at the block's gallery level. (A. Haas)



The distribution of the fortifications

The Maginot Line in north-eastern France covered a frontage of about 200km from Longuyon to the Rhine River valley. The interval casemates and the infantry casemate blocks of the *ouvrages*, which together constituted the main line of resistance, were for the most part fairly evenly distributed, with an average interval of 600 to 800m between casemates. This interval was well suited to the weapons with which the casemates were armed and generally provided for effective fire along the line of obstacles between casemates.

In contrast, the distribution of the *ouvrages* and fortress artillery was far from uniform. The heaviest concentrations were in the area to the north and north-east of Thionville, where they covered the Metz–Thionville area and the Lorraine Industrial Basin, one of France's most important industrial areas. Its loss would have been a major blow to France's ability to sustain a long war. Its proximity to Germany and its lack of natural defences made it a likely target for a German offensive in the event of war.

The defences between the Sarre River and Bitche were strengthened by a number of *ouvrages*, but between Bitche and Lembach, across the most rugged portion of the Vosges mountains, the defences consisted of interval casemates supplemented by a number of blockhouses (*blockhaus*). These blockhouses were smaller and more lightly constructed than interval casemates and were armed only with 7.5mm and 13.2mm machine guns.

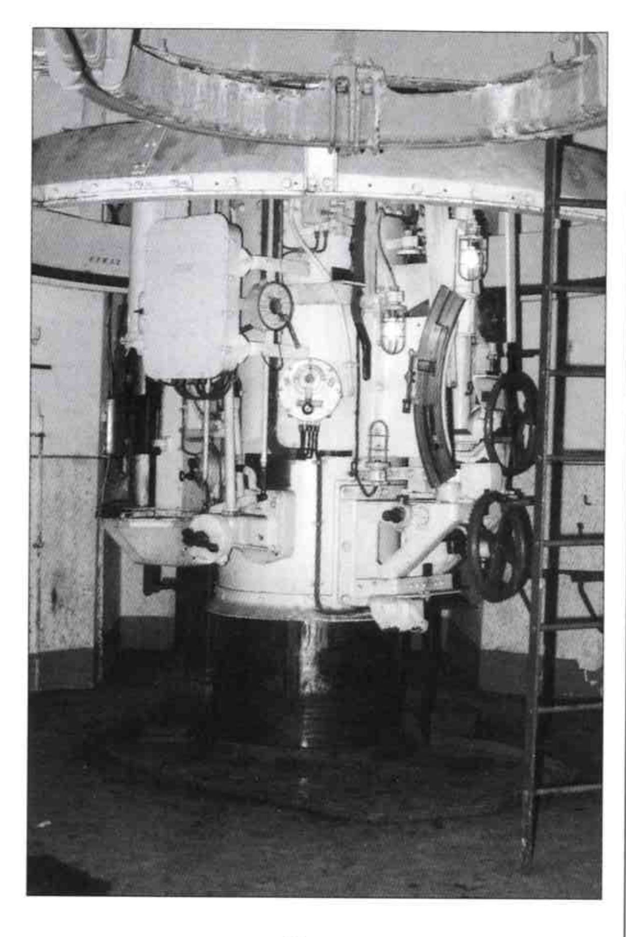
Further east, the defences of the Lembach area were particularly strong, but the northern end of the Rhine Valley was defended only by a line of interval casemates.

The 'new fronts'

Beginning in 1934, partially in response to a worsening strategic situation brought about by the inhabitants of the Saarland voting to remain part of Germany, and Belgium moving towards permanent neutrality, construction was begun on a number of extensions to the original Maginot Line. The basic concept of defence applied to the extensions was the same as that applied to the original fortifications, but the extensions came to be known as the 'new fronts' (*nouveaux fronts*) because they differed in detail in a number of ways from the original works, the so-called 'old fronts' (*anciens fronts*). The most obvious difference was the more rounded and fluid shape of the externally visible concrete of the new front works. Less visible was the fact that financial considerations meant that the new fronts were much less well provided with integral artillery than were the old fronts.

The largest area of new fronts ran from a short distance west of Longuyon along the southern edge of the Ardennes Forest to a point approximately 20km south-east of the town of Sedan, forming what was called the Montmédy Bridgehead (*tête de pont de Montmédy*), named after the town of the same name. The fortifications consisted of a line of interval casemates strengthened by only two *petits ouvrages* and two small, widely separated *gros ouvrages*. The latter each had for its artillery armament only a single 75mm gun turret. The net effect was that the *ouvrages* were much less mutually supporting than were those further east. Further to the west, some interval casemates and five small *petits ouvrages* were built in areas near the Belgian border in the vicinity of Maubeuge and Valenciennes.

Finally, a line of interval casemates and three *petits ouvrages* was built at the eastern end of the Sarre Gap connecting to the main line of old fronts in the northern Vosges mountains. The high water table along the Sarre River and other considerations meant that only part of the Sarre Gap was closed by Maginot Line fortifications. Construction of the new forts was completed in 1938.



The turret trunk of the 135mm howitzer turret of block 9 of the *gros ouvrage* of Hackenberg. The curved scale used for setting the elevation of the howitzers is to the right while the large, circular turret deflection scale surrounds the top of the trunk. The rails on which shell cages were moved within the *ouvrage* can be seen at the top of the photo. (Author's photograph)

The Rhine River defences

Almost the entire length of the French side of the Rhine River was defended by Maginot Line programme fortifications, but because of geographical considerations the scheme of defence adopted here differed significantly from that employed along the north-eastern border. First, the river itself was a significant obstacle that formed a natural first line of defence. Second, the high water table of the broad floor of the valley precluded the construction of the sort of underground galleries that *ouvrages* required. Consequently, the basic scheme of defence along the Rhine consisted of two, and in a few places three, lines of mutually supporting infantry fortifications. The main line of resistance was located two to three kilometres from the river and consisted of strong, mutually supporting, self-sufficient casemates very similar to the interval casemates employed in the north-eastern fortifications. The primary differences were that the Rhine River casemates were single storey and were generally double casemates, i.e. casemates with two firing chambers instead of one. As in the North East, the casemates were oriented to fire along the main line of resistance and the front toward the river was masked with earth. They were equipped with *cloches* for observation and close-in defence.

The most forward line of fortifications consisted of casemates positioned right along the edge of the river where their embrasures could be oriented to fire along the river bank and engage attacking forces as they attempted to land from their assault boats. These casemates were smaller than those of the main line. Their firing chambers were generally equipped with an embrasure for a standard twin machine gun and an embrasure for a 13.2mm heavy machine gun instead of an anti-tank gun. Each casemate normally also had one *cloche*. Because the casemates were situated directly on the bank of the

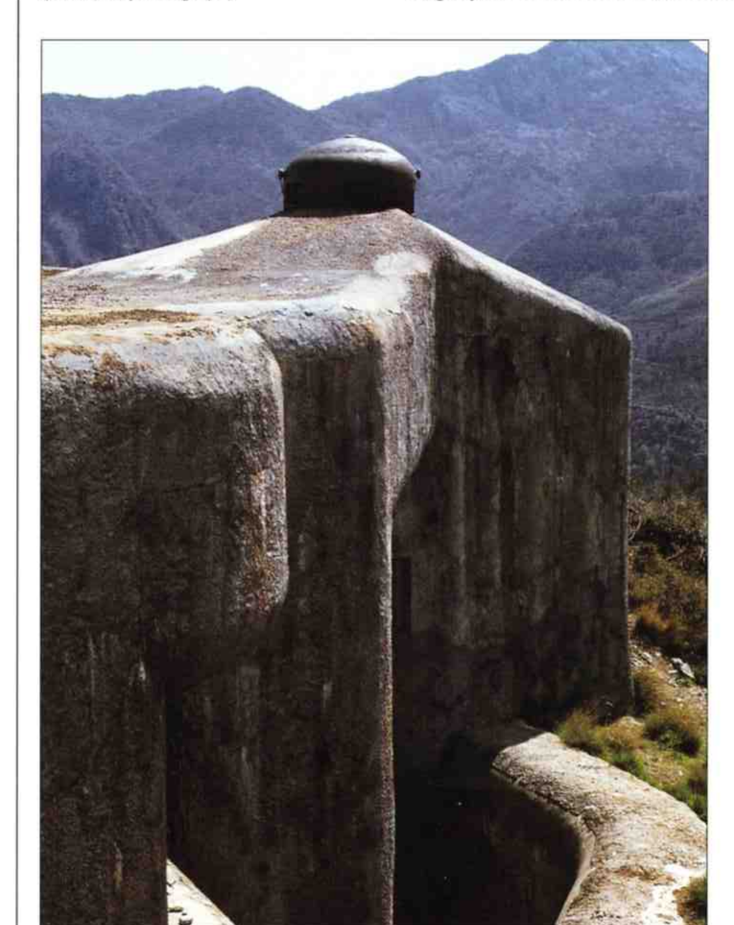
OPPOSITE PAGE The distribution of Maginot Line *ouvrages* and artillery in the Alps, based on the author's research. Each vertical bar shows the artillery armament of the *ouvrage* located directly opposite it on the map.

river, their river-facing concrete walls were fully exposed to the German side of the river, a weakness that was to prove disastrous in 1940.

Along a few parts of the river felt to be most vulnerable to assault, there were additional fortifications a short distance from the river. These consisted of a mix of relatively lightly constructed infantry casemates and troop shelters (*abris*). The shelters were generally single-storey, relatively lightly constructed blocks intended to provide accommodation and command post facilities for troops acting as local reserves. They were smaller than those in the North East, typically providing accommodation for 10–30 soldiers. Not all had *cloches*.

The Maginot Line in the Alps

In contrast to the relatively open and passable landscape along France's northern border with Germany, the Franco–Italian border runs almost entirely through rugged mountainous terrain crossed by only a few passes, for the most part the only practical invasion routes from Italy into France. Consequently, a major portion of the Maginot Line programme fortifications built in the Alps consisted of defensive positions designed to defend the passes. These positions consisted primarily of groups of mutually supporting *ouvrages*. Only in the Maritime Alps in the extreme south of the Alpine massif, where the mountains become less rugged and areas of substantial population are located fairly near the border, was a more or less continuous line of fortifications constructed. Beginning at the town of Menton on the Mediterranean, this line ran inland parallel to the Franco–Italian border for a distance of some 55km. Although their application sometimes differed, to the maximum extent possible, the standardised components employed in north-eastern France were also employed in the Alps.



BELOW Block 2 of the *gros ouvrage* of L'Agaisen looking south-east towards the Italian border. The block was armed with two 75mm 'mortars' on the upper level and two 81mm mortars on the lower level firing up from the ditch. (Author's photograph)

The Alpine combat blocks

As in north-eastern France, the primary combat position of the Maginot Line programme fortifications in the Alps was the combat block. There were many similarities between the Alpine combat blocks and those employed in the North East, but the nature of the terrain being defended also led to a number of differences. For example, it was fairly common for Alpine combat blocks to serve both as infantry and artillery blocks. The rugged, rocky nature of the terrain meant that it was often necessary to build blocks into the sides of mountains. In some cases all that could be seen was a smooth area of concrete in the face of a cliff pierced by one or two weapons embrasures.

Because it was unlikely that very heavy artillery could be deployed against the defences in the Alps, the standard of protection applied to Alpine combat blocks was generally somewhat less than in north-eastern France. With the exception of artillery turret blocks, which were as well protected as those in the North East, the thickest concrete employed in the Alps was 2.75m compared to 3.5m for the thickest in north-eastern France. In common with the works in the North East, the Alpine works were provided with air filtration equipment and *cloches*.

Petit St Bernard
N
Modane
Mont Cenis
Fréjus
Montgenèvre
Briançon
FRANCE
ITALY
(1939 border)
Larche
Restefond
Sospel
Menton
Nice
Artillery pieces
0
5
10
Ouvrages with artillery
95mm gun
75mm mortar
75mm gun
135mm howitzer
81mm mortar
Alpine pass
Petit ouvrage
Gros ouvrage
0 20 miles
0 25 km

The infantry combat blocks

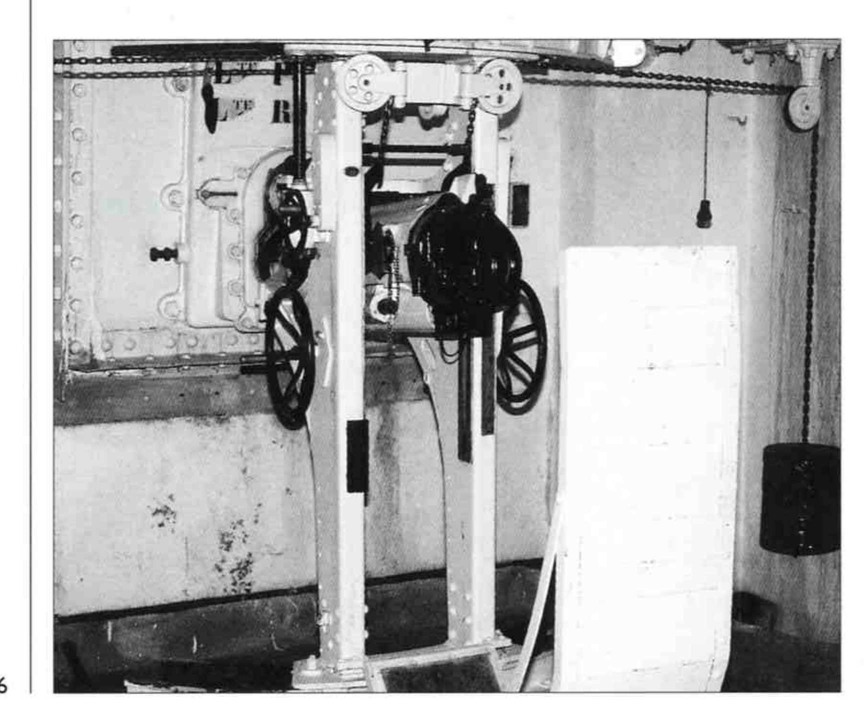
In the Alps, infantry combat blocks were constructed as required to defend likely avenues of approach into defended areas. For the most part Alpine infantry blocks were small structures that were integrated into *ouvrages* or interval troop shelters. Freestanding infantry combat blocks comparable to the interval casemates employed in north-eastern France were virtually non-existent.

Blocks were typically armed with one or two 7.5mm automatic rifles or twin machine guns firing through embrasures in the block's walls, but more heavily armed blocks were fairly common and there were also blocks that amounted to not much more than a base for a twin machine gun-armed *cloche*. Rather than being oriented to flank artificial obstacles as was the case with the infantry casemate blocks, the embrasures of the Alpine infantry blocks were generally placed to cover the avenues of approach being defended. Where a block defended a road or some other approach that was practicable for vehicles, the block was also armed with a 37mm or 47mm anti-tank gun firing through an embrasure. As in the infantry casemates in the North East, the anti-tank gun could be interchanged with a 7.5mm twin machine gun. The support facilities for the infantry combat blocks were generally located in the work to which the block was attached.

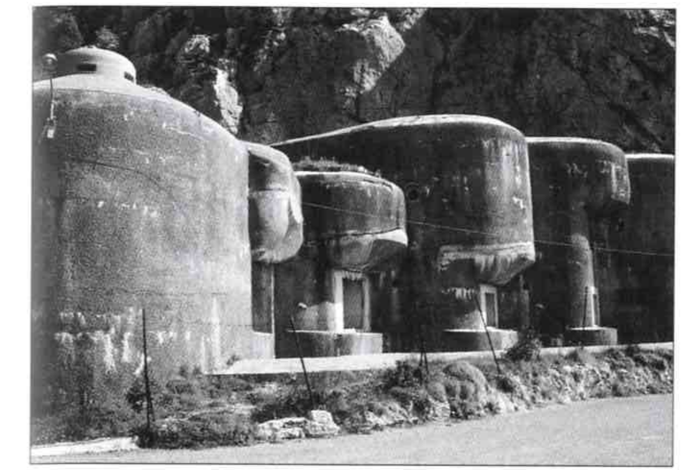
The artillery combat blocks

A total of five major types of artillery were installed in the Alpine fortifications. Three of these, the 81mm mortar, the 135mm howitzer and the 75mm gun, were the same weapons employed in north-eastern France. Weapons unique to the Alps were the 75mm 'mortar' (as it was called by the French) and the 95mm gun. As in north-eastern France, all of the weapons were mounted either in artillery casemates or in revolving, retracting two-gun turrets. The 75mm 'mortar' (*mortier*) was not a mortar in the usual sense, but rather a lightweight howitzer that fired artillery-style ammunition, not finned, mortar-style ammunition. It had a maximum range of 6,000m and was employed in situations where relatively short range, high-angle fire that could not be delivered by the 75mm gun was needed. All of these weapons were mounted in casemates. The 95mm gun was a pre-World War I pedestal-mounted former naval weapon. Only four were employed, all mounted in a casemate of an older fort that was incorporated into a *gros ouvrage*.

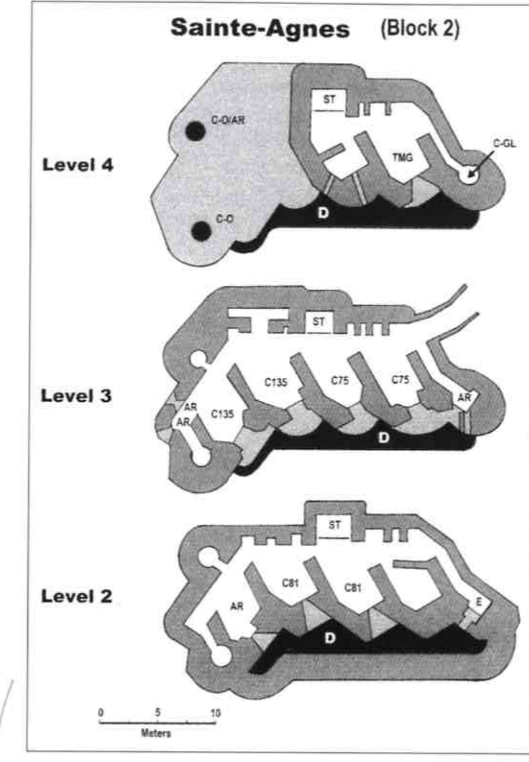
In contrast to north-eastern France where the artillery and infantry turrets were the only armament integral to the fortifications capable of engaging targets forward of the main line, in the Alps a considerable number of more economical casemate-mounted weapons were employed in a forward-firing role. This was possible because the constricted and well-defined avenues of approach common in the Alps could be effectively covered by the restricted fields of fire of casemate-mounted weapons, and because the Alpine fortifications were not likely to be subject to bombardment by as heavy artillery as those in the North East.



One of the two M1931 75mm 'mortars' of block 2 of the *gros ouvrage* of L'Agaisen. Unique to the Alps, the 75mm 'mortar' was actually a lightweight howitzer. The counterweight on the right is one of two that supports the breech of the gun. (Author's photograph)



The major difference between casemates firing to the flank and those firing to the front was that the embrasures of those firing forward were more heavily armoured than those firing to the flank. Like the artillery embrasures in north-eastern France, the artillery embrasures in the Alps were normally protected by overhanging concrete and by ditches. Because it was possible to employ casemate-mounted weapons firing to the front, only six artillery and no infantry turrets were installed in the Alpine fortifications. The turrets that were installed were identical to those used in north-eastern France.



Alpine artillery casemate blocks tended to be more heavily armed and less standardised than those in the North East. Different types of weapons were frequently mounted in the same block, and blocks often had embrasures firing in different directions. Weapons were generally mounted in pairs. A two-storey arrangement was common with a pair of artillery pieces firing through embrasures on the upper level and a pair of 81mm mortars on the lower level firing up through embrasures in the block's ditch. Blocks so equipped might have other pairs of weapons firing in different directions.

Block 5 of the *gros ouvrage* of Lavoir, defending several small passes in the area just to the west of the Fréjus Pass, was one of the more heavily armed Alpine artillery blocks. It had one pair of 81mm mortars and a pair of 75mm 'mortars' firing to the south-west and another pair of 81mm mortars firing to the south-east. Unlike many other artillery blocks in the Alps the weapons of this block were all located on the same level. Block 2 of the *gros ouvrage* of Cap Martin, the southernmost of all the *ouvrages*, had an artillery armament consisting of a single 75mm gun flanking the beach at Menton. The block also served as an infantry combat block with an armament of three twin 7.5mm machine guns. The most heavily-armed artillery block in the entire Maginot Line fortifications programme was block 2 of the *gros ouvrage* of Sainte-Agnès. It was a four-level structure overlooking the town of Menton, and was armed with two 135mm howitzers, two 81mm mortars, and two 75mm 'mortars'.

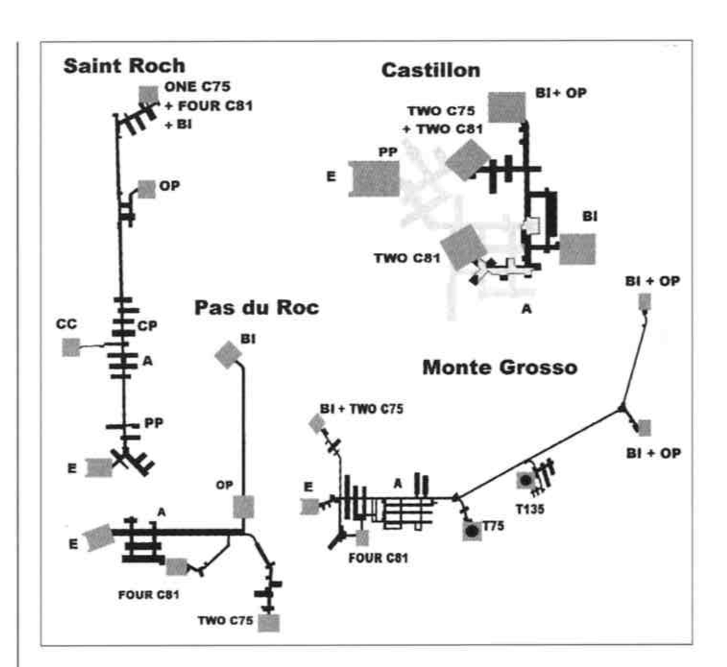
ABOVE RIGHT Block 2 of the *gros ouvrage* of Sainte Agnès is generally accepted to be the most heavily armed combat block in the entire Maginot Line programme. It is spectacularly sited overlooking the town of Menton and fires over the town toward the Mediterranean Sea. The two 75mm weapons are 75mm 'mortars'. Not shown in the plan is the block's lowest level, which contains the machinery for the lift that transports ammunition to the other levels. (Eric Halter/John Richards)

ABOVE LEFT The top two of the block's four levels are visible in this photo. The 135mm howitzer and 75mm 'mortar' embrasures can be seen at ground level. At the upper left is the observation *cloche*. (Author's photograph)

The *ouvrages*

In the Alps *gros* and *petits ouvrages* similar in many respects to those used in north-eastern France were the main components of each defensive position. Both types of *ouvrages* existed in equal numbers, 22 of each.

Alpine *petits ouvrages* generally had from one to four surface blocks interconnected by galleries. The blocks included infantry combat blocks, observation blocks, and possibly an entrance block. The exact mix employed at each *ouvrage* depended on local site requirements and was much less



Examples of Alpine *gros ouvrages*. Castillon is a particularly compact *ouvrage* with a dual-level support area. Monte Grosso is one of only two *ouvrages* in the Alps with two turret blocks. In all cases, casemate-mounted artillery was mounted in pairs and individual pairs within a block generally fired in different directions. Except for two 75mm 'mortars' in the *gros ouvrage* of Pas du Roc, all the 75mm weapons shown in the plans are 75mm guns. (Eric Halter)

standardised than in north-eastern France. The garrison of a *petit ouvrage* generally consisted of one or two officers and 40–80 enlisted men.

Alpine *gros ouvrages* consisted of varying mixtures of artillery and infantry combat blocks and observation blocks together with an entrance block and subterranean support facilities, and were generally smaller than those in the North East. The average Alpine *gros ouvrage* had three or four combat and observation blocks and mounted about six artillery pieces. The garrisons of the largest Alpine *ouvrages* were less than 400 officers and men. The *gros ouvrage* of Pas du Roc, one of those defending the Fréjus Pass near Modane, was a fairly typical Alpine example. It had a total of five blocks: an artillery combat block with two pairs of 81mm mortars; another with a pair of 75mm 'mortars'; an infantry combat block; an observation block; and an entrance block. One of the largest was the *gros ouvrage* of Monte Grosso, situated on a commanding hilltop north of the town of Sospel in the Maritime Alps. It had a total of seven blocks: two artillery turret blocks, one with a 135mm howitzer turret and the other with a 75mm gun turret; a block with two 75mm guns as well as an embrasure for a twin machine gun; a block with two pairs of 81mm mortars; two combined infantry defence and artillery observation blocks; and an entrance block. One of the smaller ones was the *gros ouvrage* of Saint-Roch near Sospel. Its entire artillery armament of one 75mm gun and two pairs of 81mm mortars was installed in a single artillery casemate block. Each of the *ouvrage*'s other two combat blocks mounted only a single *cloche*: one an artillery observation *cloche*, the other an observation and automatic rifle *cloche*. It also had an entrance block.

The support areas of the Alpine *ouvrages* were similar to those in north-eastern France, with most of the same facilities, but on a generally smaller scale commensurate with the smaller garrisons of the Alpine *ouvrages*. One feature that was lacking in the Alpine *ouvrages* was an M1 magazine: instead ammunition was stored in magazines located in the vicinity of and in the combat blocks themselves. As in the North East, the support area was located well below ground level in order to isolate it as much as possible from the battlefield. Because the Alpine *gros ouvrages* were built high up the slopes of steep hills, the support areas were usually located directly below the combat blocks. Locating the support area close to the combat blocks eliminated the need for an electric railway to transport ammunition and supplies within the *ouvrage*. The *ouvrage*'s principal galleries were, however, fitted with tracks and small, hand-pushed rail trucks were used to transport heavy supplies and equipment. Galleries and shafts connected the support facilities to the surface blocks. As in north-eastern France, shafts serving artillery combat blocks were fitted with lifts to transport ammunition from the gallery level to the block itself.

The standard Alpine entrance block was a combined garrison and ammunition and supplies entrance block. Like the entrance blocks in north-eastern France, which it resembled, it was protected by a ditch and was defended by infantry weapons firing through embrasures and sometimes also by one or more *cloches*. It had two side-by-side entrances, a small one for the troops of the garrison and a larger one for ammunition and supplies. The ditch in front of the entrances was crossed by two bridges: a removable one serving the troop entrance and a drawbridge serving the supplies entrance. The



The entrance block of the *gros ouvrage* of L'Agaisen in the Maritime Alps. Its combination armoured door/drawbridge is in the half-raised position. Beyond the drawbridge, the garrison entrance door with its removable bridge and an automatic rifle embrasure are visible. (Author's photograph)

drawbridge was armoured and, in its raised position, formed an armoured door. In the Alps it was generally possible to locate the entrance blocks on the same level as support areas. A feature unique to the Alps was the aerial cableway entrance found in *gros ouvrages* that were difficult to approach by road. The cableway entrance was sometimes part of the main entrance block and sometimes a separate block. In either case the block served as the uphill terminus of an aerial cableway that was used to carry supplies to the *ouvrage*.

Because Alpine *ouvrages* were often in sight of one another, provision was made for visual communication between works in addition to the normal telephone and radio links. This consisted of small round embrasures in the exterior walls of combat blocks aligned in such a way that signal lamps could be used to communicate between works in a manner similar to that used between ships at sea.

The distribution of the fortifications

Each of the major passes along the Franco–Italian border was defended by a small group of *ouvrages* forming a defensive position. The *ouvrages* of each group were generally mutually supporting, however they were not interconnected by a line of permanent obstacles. The number and type employed in each group varied considerably from two *petits ouvrages* defending the Petit Saint-Bernard Pass to five *gros ouvrages* and one *petit ouvrage* defending the Fréjus and Mont Cenis passes.

In the Maritime Alps a more or less continuous line of *ouvrages* was built. On a map, this line bears a superficial resemblance to the Maginot Line in north-eastern France, but it lacked the continuous line of obstacles and infantry casemates that was a key component of the latter. Instead, the *ouvrages* were closer together and infantry defences were confined primarily to the avenues of approach to the main line of defence. As in north-eastern France, the principal defensive positions in the Alps were, for the most part, located a few kilometres from the border. The positions also included a number of interval troop shelters and a few other structures. The troop shelters resembled *petits ouvrages* except that they contained additional sleeping and command

post facilities at the gallery level for one or two sections of Alpine Infantry. The mission of these troops was to fight in the open to cover gaps between the fortifications.

Most of the positions in the Alps had been fortified in preceding centuries. Many of the older fortifications still existed and a number of forts dating from 1870 to 1914 were modernised and incorporated into the Alpine defences. Modernisation consisted mainly of providing modern lighting and protection against poison gas similar to that found in the new works.

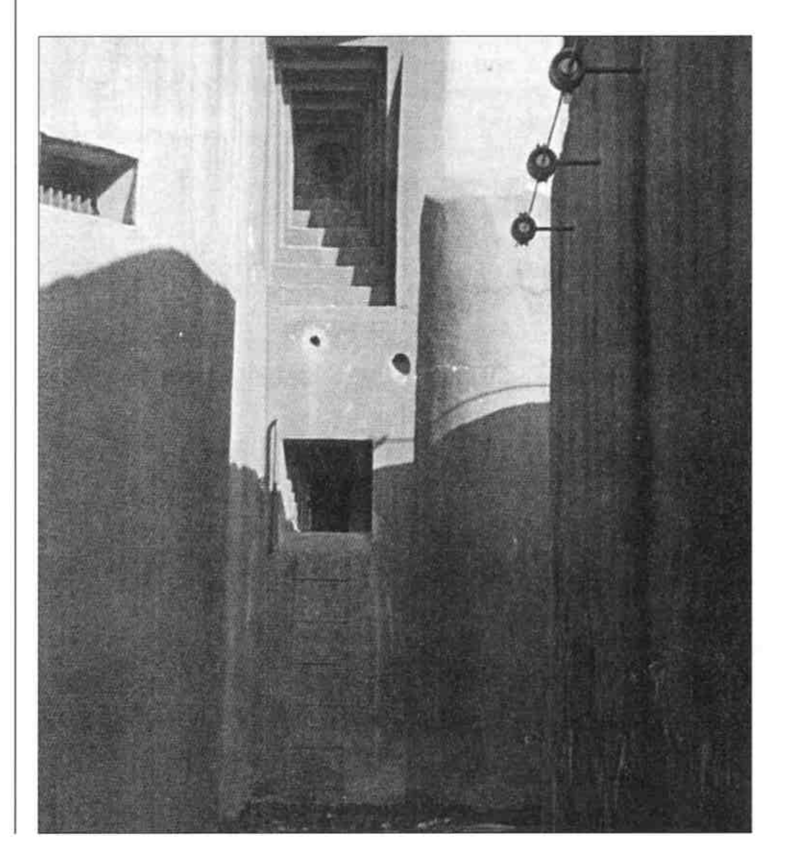
Corsica

Corsica was viewed by the French as an unsinkable aircraft carrier guarding the key shipping routes to its North African colonies. Consequently, defences for it were included in the original Maginot Line programme. A total of 24 works were built, sited to defend likely points of invasion. For the most part the works consisted of casemate blocks similar to the interval casemates constructed in north-eastern France, but three of the casemates were armed with 75mm guns. There were also five troop shelters.

Subsequent construction

The Maginot Line's designers had made plans for a second cycle of works that would greatly strengthen the fortifications: more combat blocks, *petits ouvrages* upgraded to *gros ouvrages*, and more and better anti-tank defences. However, the engineers' plans for improved fortification met with political reluctance to pay for them, and the second cycle was never built. For all practical purposes, the dissolution of CORF in 1936 marked the end of the development of the Maginot Line. Fortification construction did continue but what was constructed during the years leading up to the outbreak of World War II was less expensive and hence less sophisticated.

The ditch of block 3 of the *gros ouvrage* of Hochwald. Directly ahead is the block's emergency exit and above that is an embrasure for an automatic rifle. On the left is an air vent, while on the right a radio antenna is visible. (A. Haas)



Advance posts or fortified houses

In some areas of north-eastern France, small fortified advance posts were constructed near points where roads crossed the border. Each was garrisoned by a few soldiers from the paramilitary *Garde Républicaine Mobile* whose mission it was to report and delay any surprise attack, thus giving the garrisons of the *ouvrages* and interval casemates of the main line of resistance added time to achieve full combat readiness. The advance posts were collectively known as fortified houses (*maisons fortes*) and were of two general types. Those constructed in the Moselle area were rectangular, three-room, single-storey concrete structures with small projecting blockhouses with firing embrasures for small arms. Those constructed in the Ardennes Forest area and in some places in the Vosges mountains resembled two-storey houses. The lower storey was in fact a concrete blockhouse with firing embrasures for small arms and sometimes an anti-tank gun, while the upper storey provided living accommodation for the garrison.



LEFT A portion of the primary filter and ventilation equipment in the support area of the *gros ouvrage* of Schoenenbourg. The large drums hold the air filters. Unfiltered air is forced into them from the ducts at the bottom by the fan in the background while filtered air exits from the top. (Marc Halter)

Alpine advance posts

In the Alps prior to the outbreak of World War II, a number of advance posts were constructed forward of the main defensive positions along major avenues of approach and at key points near the border. Their mission was to provide advance warning and to delay an enemy attack. A number also served as artillery observation posts. A few of the advanced posts consisted of a single infantry combat block but most had plans that bore a superficial resemblance to those of *petits ouvrages* with a small number of lightly armed infantry combat blocks interconnected by underground galleries or trenches. The advanced posts were, however, much smaller and more lightly constructed. Their armament consisted of standard infantry weapons firing through embrasures and their support facilities were on a much lesser scale than those of the *petits ouvrages*. They lacked both electric power and sophisticated ventilation systems. The garrison of an advance post generally consisted of one officer and a small number of enlisted men.

Fortifications de campagne

Construction of *fortifications de campagne* (literally 'field fortifications') took place all along France's borders throughout the latter part of the 1930s and right up to the German invasion in June 1940. The basic goals were to add depth to the Maginot Line defences and to fill the gaps where Maginot Line works had not been built. The works constructed varied from substantial ones that bore a superficial resemblance to Maginot Line casemates but which lacked their strength and sophistication, to flimsy, unreinforced-concrete pillboxes that provided little more than an illusion of protection. The details of these are beyond the scope of this book.



Pre-war life in the Maginot Line

Specialised units of fortress infantry, artillery and engineers were raised to man the fortifications. The fortress infantry units both manned the interval casemates and the infantry weapons of the *ouvrages* and provided the infantry component of the interval troops whose mission it was operate outside the fortifications, supporting them and containing any possible hostile penetration of the line. Like the infantry, the fortress artillery units had a dual role. They manned both the artillery integral to the *ouvrages* and the field artillery that supported the interval troops and provided offensive firepower forward of the line. In north-eastern France and along the Rhine River alone the field artillery totalled more than 1,200 pieces. The vast majority of these were 75mm and 155mm guns and howitzers but there were a small number of heavy guns ranging in calibre from 220mm to 370mm. The mission of the fortress engineer units was to operate and maintain all of the specialised equipment within the fortifications other than the weapons. They also operated most of the communications equipment.

The Maginot Line fortifications were organised geographically, primarily into fortified sectors, the majority of which were further divided into subsectors. Beyond that most of the fortified sectors in north-eastern France formed part of either the Metz or Lauter Fortified Regions. Fortress unit organisation roughly corresponded to the geographic organisation. In addition, the artillery was organised into groups for co-ordination purposes.

Each fortress unit was made up of both active duty and reserve soldiers. The active duty component consisted in large part of the highly trained specialists who were required to keep the works ready for war and who could man them at a moment's notice in the event of a surprise attack. The reserves were drawn from the local area so that they could be rapidly mobilised to reinforce the active duty troops and bring them up to wartime strength.

The soldiers of the fortress units wore special insignia that made them easily recognisable, the most prominent being a distinctive beret badge bearing the motto of the Maginot Line '*On ne passe pas*', usually translated as 'None shall pass'. Not surprisingly given their mission as France's first line of defence and the immense amounts of money that had been spent on the Maginot Line, the fortress troops considered themselves to be among the elite of French Army and they were renowned for their high morale.

The Maginot Line works, especially the *ouvrages*, were cold, damp, dreary, and generally uncomfortable places in which to live. Consequently, permanent

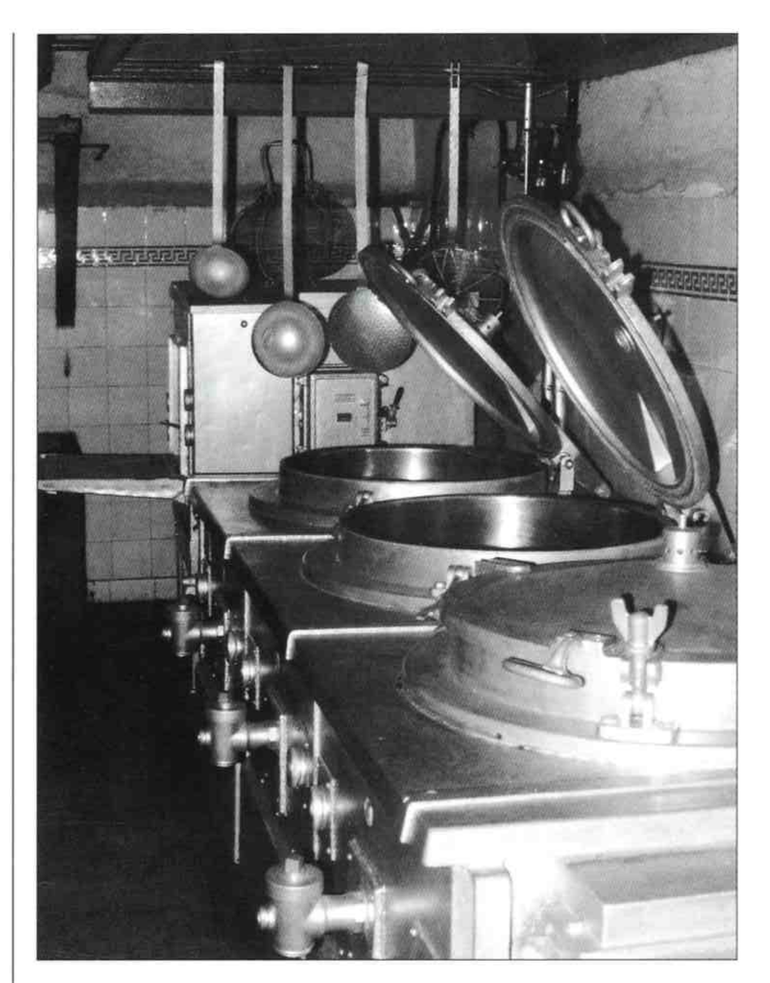
The Maginot Line in the Maritime Alps

Looking south-west along the line of Maginot Line fortifications near the town of Sospel in the Maritime Alps. L'Agaisen and Saint-Roch are middle-sized Alpine *gros ouvrages*. The garrison of L'Agaisen numbered about 300 officers and men while Saint-Roch had a garrison of just over 200. The *ouvrages* of L'Agaisen have been depicted uncovered to show their positions more clearly.

Fort Barbonnet was built in the 1880s. Its primary armament consists of two turrets, also dating from the 1880s, each armed with two 155mm guns. The turrets were renovated in the 1930s and incorporated into the Maginot Line programme defences. The small Maginot Line *gros ouvrage* of Barbonnet was also built on the hilltop adjacent to the fort. The distance from the L'Agaisen to Fort Barbonnet is about 3km.

The majority of the casemate-mounted artillery in this area fires generally north or south along the line of the *ouvrages*, but the 75mm gun and two of the 81mm mortars in block 4 of Saint-Roch fire to the east over Sospel. They defend the valley to the east of the town through which runs a road from Italy.

This section of the Maginot Line was involved in the fighting against the Italians in 1940 with Fort Barbonnet's two turrets proving to be particularly effective.



The kitchen of the *gros ouvrage* of Hackenberg. In the foreground are three large pressure cookers; beyond them is the baking oven. (Author's photograph)

barrack complexes were provided for the regular army portion of the fortress troops. These were constructed at intervals along the line close enough to the fortifications so that the troops could conveniently train in them and maintain them while living in relative comfort. Immediately adjacent to each *gros ouvrage* a small complex of buildings was constructed to provide temporary accommodation for those troops whose duties required them to spend longer periods at the *ouvrages*. These buildings were constructed of wood so that they could easily be knocked down in the event of war.

Training and preparing for war

The fortress units trained in the works they garrisoned, but because the fortifications were located in civilian areas it was not possible to actually fire their weapons. To circumvent this limitation, mock-ups of infantry weapon emplacements were built at local firing ranges where automatic rifles, machine guns, and in some cases anti-tank guns could be fired. To practise live fire with artillery weapons, the troops periodically travelled to the vicinity of the town of Bitche in the northern Vosges mountains, where a *gros ouvrage* was situated in a military training area and artillery live fire was possible.

The garrisons carefully surveyed the area around each *ouvrage* so that fire could quickly and accurately be brought to bear on any target that came within range. To make it easier for observers to pinpoint targets, annotated panoramic photographs of the surrounding area were prepared for each *cloche* and similar photos were prepared for the *ouvrage* command posts.

In March 1936, in response to Germany's re-militarisation of the Rhineland, the fortress troops were mobilised and moved into the fortifications for the first time. Problems were encountered with the works themselves, especially dampness and poor lighting. Difficulties were also experienced integrating the various components of the garrisons. As soon as the crisis was over, steps were taken to address the problems. Lighting was improved where possible and the problems associated with damp were alleviated somewhat although they were never completely solved.

In an effort to improve the functioning of the *ouvrage* garrisons, officers were sent to study the way the crews of naval ships operated. The result was the adoption of a naval-style organisation for the *ouvrages* with the garrisons being divided into watches similar to those used on ships.

The myth of the Maginot Line

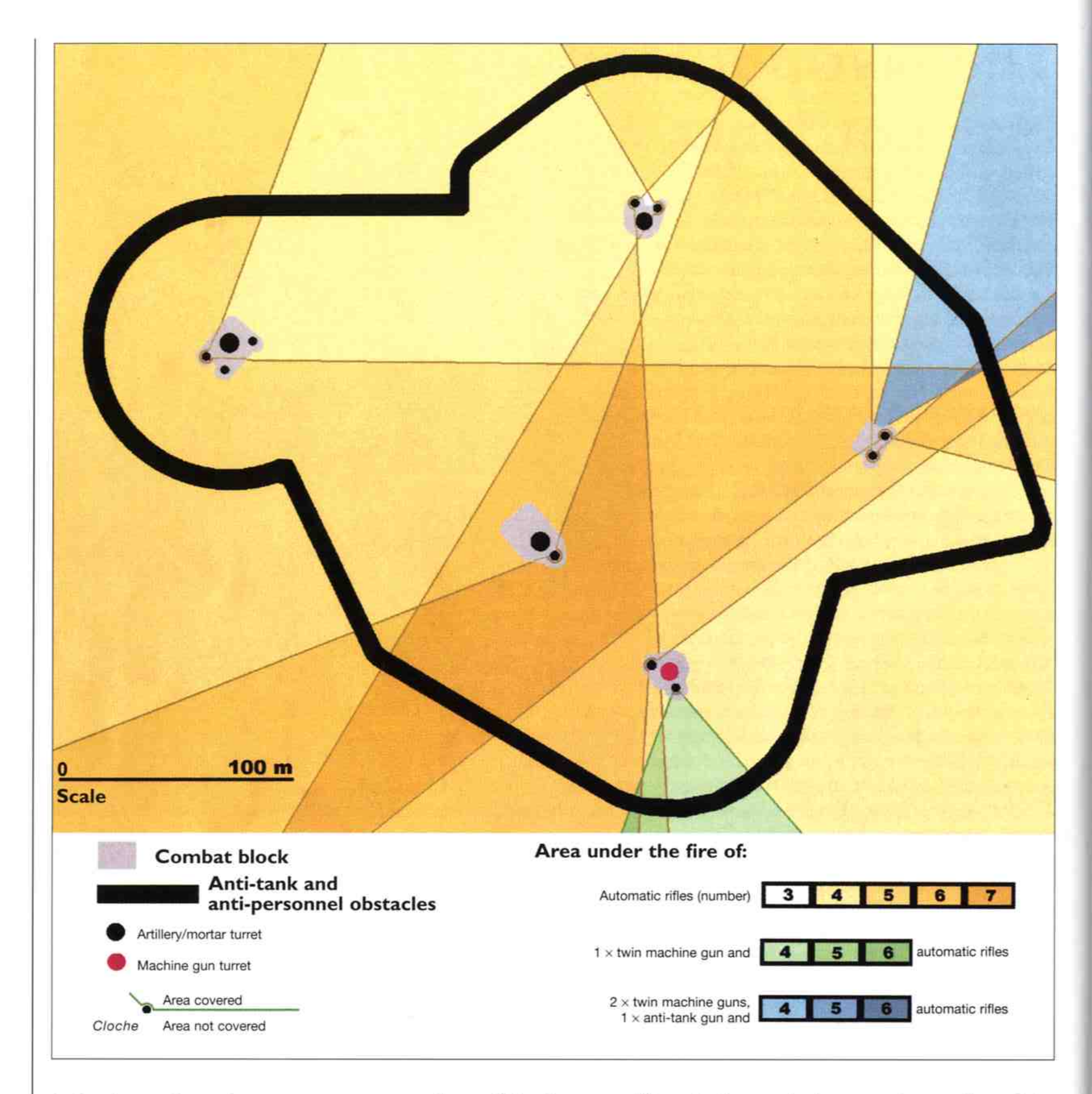
The existence of the Maginot Line was never intended to be a secret. To the contrary, since one of its major purposes was to deter attack, it was important that potential enemies know of its existence. In any case, it would not have been possible to keep it secret. France was a democratic society, and the debates surrounding its construction and funding were public knowledge and widely discussed in the press. Beyond that, the scope of the construction was massive and could not have been hidden, especially since all of the fortifications in north-eastern France were constructed in areas of France that Germany had occupied from 1870 to 1918 and that still contained a portion of the population that was sympathetic to Germany. Concerted efforts were made to keep the details secret however. The plans of individual works and their exact locations were classified information. Photographing construction sites was prohibited. The actual sites occupied by the completed works were off limits. All this meant that the public had little real information about the fortifications.

There are indications that the French government made efforts to exaggerate their strength and extent in an attempt to increase their effectiveness as a deterrent. While a few fairly accurate reports describing various aspects of the Maginot Line did appear in the press in the 1930s, most published reports were full of fanciful exaggeration. Frequent mention was made of an impregnable line of fortifications running from the English Channel to the Swiss border. Reports spoke of all the forts being connected together by an underground rail network. Others claimed that the forts were invisible from the air. In 1936 the *Daily Express* of London published what was purported to be a cutaway drawing of one of the '£30,000,000 Forts of the "Maginot Line".' It showed a seven-level, hundred-metre-deep structure that looked more like an underground hotel than an actual *ouvrage*. There was even a streamlined express train shown running through one level. But it was not just press accounts that kept the Maginot Line in the public eye. There were novels that centred around the Maginot Line and in 1938 even a feature film, *Double crime sur la Ligne Maginot*.

As late as 1939 the French government was still engaged in deception. While it did release photos and newsreel footage taken inside Maginot Line *ouvrages*, the purported exterior views actually showed pre-World War I forts built by the Germans while they had occupied Alsace-Lorraine. All this fed the myth of an invulnerable Maginot Line and it is clear that much of the public, and perhaps even some within the French military, bought into the myth, holding exaggerated expectations as to the Maginot Line's ability to save France from invasion – expectations that were doomed to disappointment.

The German view

Based on their public statements, it seems clear that at least some individuals within the German military were also taken in by the myth. However, the German intelligence services were not. An extensive German military report compiled in 1935 and 1936 quite accurately described the Maginot Line fortifications, not only correctly identifying their general locations and relative strengths, including those in the Alps, but also providing details of their armament. A subsequent report prepared in 1937 contained accurate, detailed plans of several *ouvrages*, plans that were too detailed to have been drawn simply from memory by a German military attaché who had been given a quick tour of them. Both reports contained inaccuracies, but they do show that at least



A plan showing the overlapping potential fields of fire of the close-in defences of the combat block area of the *gros ouvrage* of Michelsberg. The twin machine guns and anti-tank gun of the infantry casemate block at the right and the *cloche*-mounted twin machine gun at the bottom fire along the line of obstacles (not shown) connecting the works together. The plan does not reflect dead ground, but in general care was taken during construction to avoid dead ground to the maximum extent possible. (Eric Halter)

some sections of the German military had a much clearer understanding of the strengths and weaknesses of the Maginot Line than did the general public. It is not known how the Germans obtained the information on which these reports were based. Certainly, spying played a significant role, but some information may also have been obtained from those directly involved in building the fortifications. Construction had required more labour than was available from the French work force. As a result, large numbers of foreign labourers had been employed including many from Germany.

The Maginot Line at war

Tension in Europe had been high since Germany's *Anschluß* (annexation) of Austria in March 1938 and its subsequent occupation of the Sudetenland, the largely German-speaking regions of Czechoslovakia that bordered Germany and Austria. On both these occasions the French fortress troops had been temporarily mobilised and the fortifications had been placed on a war footing. Tensions continued to rise throughout the first half of 1939. In March, Germany seized the rest of Czechoslovakia and began to exert increased pressure on Poland for concessions on Danzig and the Polish Corridor, former German territories that it had be forced to relinquish after World War I. By August it was clear that Poland, having seen what had happened to Czechoslovakia, would fight rather than make concessions. War between Germany and Poland appeared inevitable and France and Britain, as Poland's allies, were sure to be pulled in.



ABOVE An unusual variant of the Maginot Line beret insignia. In the standard version, the central image is reversed and the sky area is cut away. (Paul Szymanski Collection)

BELOW A theatrical show staged by the garrison in the galleries of the *gros ouvrage* of Hochwald, to help relieve the monotony of the 'Phoney War'. (A. Haas)

On 21 August, France again began mobilisation of the Maginot Line and the forces whose mission it was to provide the first line of defence along its borders. This was a step-by-step process over several days: the peacetime garrisons moved into the fortifications and readied them for combat, the reserve portions of the fortress troops were called to active duty, and steps were taken to secure the borders against surprise attack. At 0545 on 1 September 1939, Germany invaded Poland. In response to its treaty obligations, the French government ordered general mobilisation and prepared for war. The border with Germany was closed and evacuation of the civilian population in border areas began. Britain too ordered mobilisation and made preparations to move a large part of its army to France.

The 'Phoney War'



Polish resistance was crushed and Poland was occupied in a matter of weeks, but in the West, not much happened. Anglo–French mobilisation was slow and in any case the Allied strategy was primarily defensive in nature, relying on blockade, economic strangulation, and fortifications to wear down Germany and lay the groundwork for an Allied offensive sometime in the future. France did launch a very tentative and limited offensive into the Saarland, but it was abandoned after gains of a few kilometres when it became clear that it would do nothing to take the pressure off the Poles. What gains that were made were lost when the Germany army redeployed to the west after the end of the Polish campaign.

The western front settled into a period of watchful waiting, punctuated only by skirmishing along the Franco–German border, a period that came to be known as the 'Phoney War'. But it was not a period of complete Allied inactivity. Construction of *fortifications de campagne* continued at a feverish pace, but the works built were for the most part lightweight, unreinforced-concrete structures that provided little real protection. The Allies were confident that the strength of the Maginot Line would deter Germany

from directly attacking France. The popular press went even further. On 17 May 1940, *The Illustrated London News* reported: 'the Allies only suffered 1,500 casualties in the first five months [of this war] in contrast to 720,000 men lost by France alone in the opening months of the last war – the difference being largely attributable to the security afforded by the Maginot Line, which makes German invasion schemes seem mostly futile.'

But not everyone was so sanguine. General Sir Alan Brooke, a corps commander in the British Army, paid two visits to Maginot Line *ouvrages* in late 1939 and early 1940 and set down his impressions in his diary:

> [T]here is no doubt that the whole conception of the Maginot Line is a stroke of genius. And yet! It gives me but little feeling of security, and I consider that the French would have done better to invest the money in the shape of mobile defences such as more and better aircraft and more heavy armoured divisions rather than to sink all this money into the ground.

And later;

> [the Maginot Line fortifications'] most dangerous aspect is the psychological one; a false sense of security is engendered, a feeling of sitting behind an impregnable iron fence; and should the fence perchance be broken, the French fighting spirit might well be brought crumbling with it.

The Allied high command did expect a German attack though, one that would come through Holland and northern Belgium, in effect a rerun of Germany's Schliefen Plan attack of 1914. But preparations for such an attack were handicapped by the strict neutrality that Belgium and Holland continued to maintain. Consequently, a majority of the Allied mobile forces including Britain's contribution, the British Expeditionary Force, were deployed along the Franco–Belgian border intending to move into Belgium to act in conjunction with Belgian and Dutch forces in meeting the attack as soon as Germany violated their neutrality. France's other borders were not ignored, however, and significant reserves were deployed behind the Maginot Line both in north-eastern France and in the Alps.

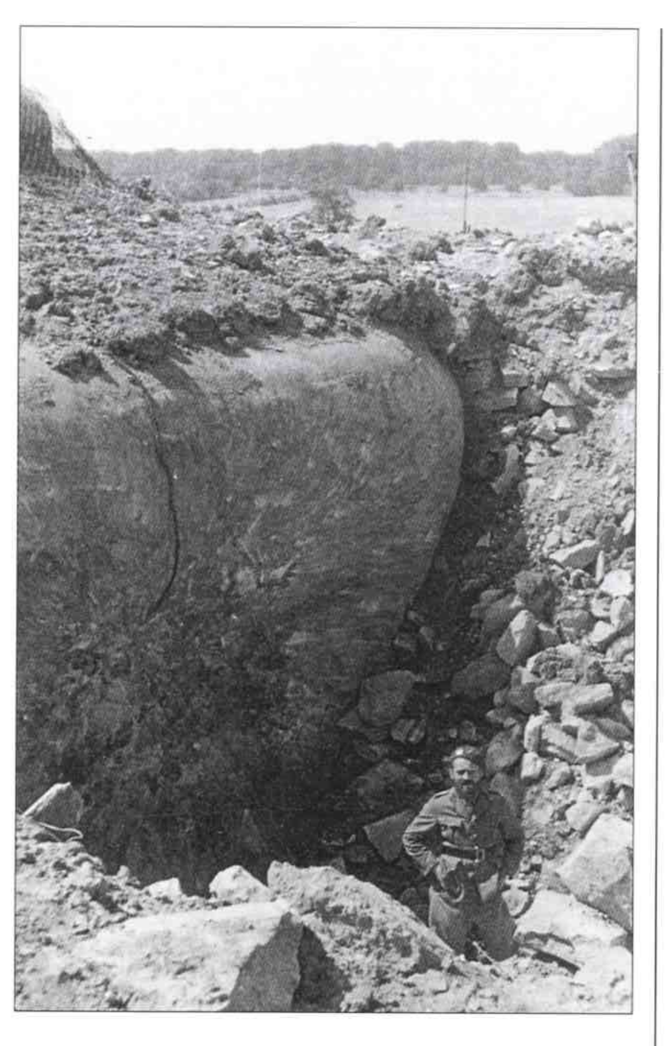
Belgium and Holland, although neutral, had not neglected their defences and both had constructed extensive fortified positions to defend against an attack by Germany. Crucially however, Belgian had concentrated its fortifications in the more open and industrial northern part of the country leaving the Ardennes Forest area in the south only lightly defended.

In fact the original German campaign plan for the west had called for an attack similar to that carried out in 1914. As the 'Phoney War' continued though, and Germany gobbled up Denmark and Norway, that plan was drastically revised to one that would ultimately lead to one of the most crushing victories in the history of warfare.

Blitzkrieg and the Battle of France

The revised German plan called for a concerted attack along the entire length of Dutch and Belgian border supported by airborne and gliderborne assaults to seize crucial bridges and the key Belgian fort of Eben Emael. But the main thrust was to be made by the full concentration of Germany's armoured and mechanised forces through Luxembourg and the Ardennes Forest with the goal of bypassing the Allies' fortifications and breaking through their front line where it was weakest.

Germany attacked early on 10 May 1940, achieving immediate and relatively easy successes against the Dutch and Belgian forces. France and Britain responded as planned by advancing into Belgium to meet the attack and by 12 May they were in contact with the German forces along a generally north–south line in central Belgium. On 13 May the German armoured spearheads began to emerge from the Ardennes, seizing bridgeheads across the Meuse River. The Allied high command, beginning to sense its peril, ordered reinforcements to the Ardennes sector, but it was too late. The slow-moving Allied forces were no match for the German blitzkrieg. Using a combination of superior tactics and tightly integrated Luftwaffe close air support, the German armoured spearheads broke through the French lines and began a race to the sea. The lead elements reached the coast near the mouth of the Somme River on 20 May, cutting the Allied armies in half and pinning the British Expeditionary Force and a major portion of the French Army against the English Channel in an ever-shrinking pocket centred on the port of Dunkirk.



The results of a bomb dropped by a German Ju 87 Stuka dive-bomber on the *gros ouvrage* of Hochwald. Of note is the fact that the concrete of the adjacent block is virtually undamaged. (A. Haas)

By 4 June portions of the German forces had succeeded in eradicating the Dunkirk pocket, but not before the Allies had evacuated over 300,000 troops to Britain. Meanwhile the rest of the invading forces were engaged in holding the line of the Somme and Aisne rivers against what weak counter attacks the Allied forces that had not been trapped in the pocket were able to muster.

The Allies desperately tried to put together a defensive position along the Somme and Aisne to meet the German attack that they knew was coming. Virtually all available forces were ordered to the area, stripping the Maginot Line of most of the mobile reserves and artillery needed to support it and contain breakthroughs. But in spite of this, the forces facing the Germans were seriously outnumbered. Beyond that, their morale was generally low.

Even as the Germans were finishing eradicating the Dunkirk pocket, they were redeploying their forces for the second phase of the campaign. Early on 5 June, they attacked along the whole length of the Somme–Aisne front, encountering stiff resistance in spots, but soon breaking through along wide areas of the front. Lead by their armoured forces, they began driving deep into France against what was for the most part only weak opposition. By 14 June Paris had fallen and the French retreat had turned into a rout. As the main body drove deeper into the heart of France, units on the left flank hooked back to take the Maginot Line from the rear.

The Maginot Line under siege

Throughout the period, the German forces that had been left to watch the Maginot Line and guard the German frontier had been preparing for their own offensive. On 14 June they launched it, as what was left of the interval troops facing them began a general withdrawal. The main German attacks came through the Sarre Gap and around the western end of the line. Unmolested by interval troops, the Germans were able to attack the Maginot Line fortifications from their more vulnerable rear. Several *petits ouvrages* located too far from a *gros ouvrage* to be supported by its artillery were taken. But in spite of being backed up by the Luftwaffe and the heaviest artillery the Germans could find, including the last 'Big Bertha' 420mm siege gun remaining from World War I, no significant progress was made against any of the *gros ouvrages*.

155mm gun or howitzer battery

75mm gun battery

town or village

Ouvrage combat block

Ouvrage entrance block

interval casemate

observation post

area occupied by 51st Infantry Division units

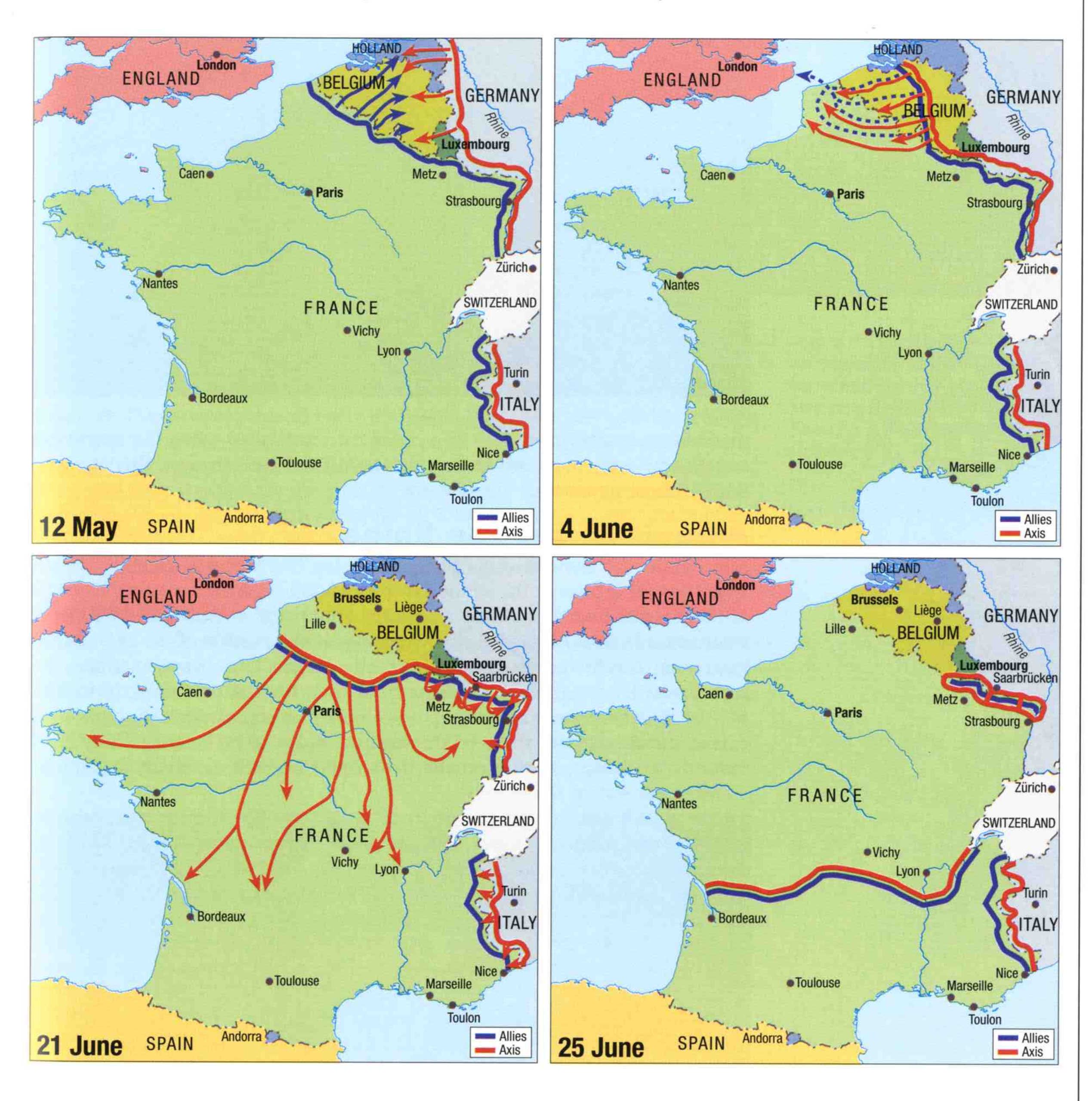
area occupied by fortress units

Anti-tank and barbed wire obstacles

Fortress units
I/149e RIF – 1st Battalion, 149th Fortress Infantry Regiment
III/46e RAMF – 3rd Group, 46th Motorised Fortress Artillery Regiment

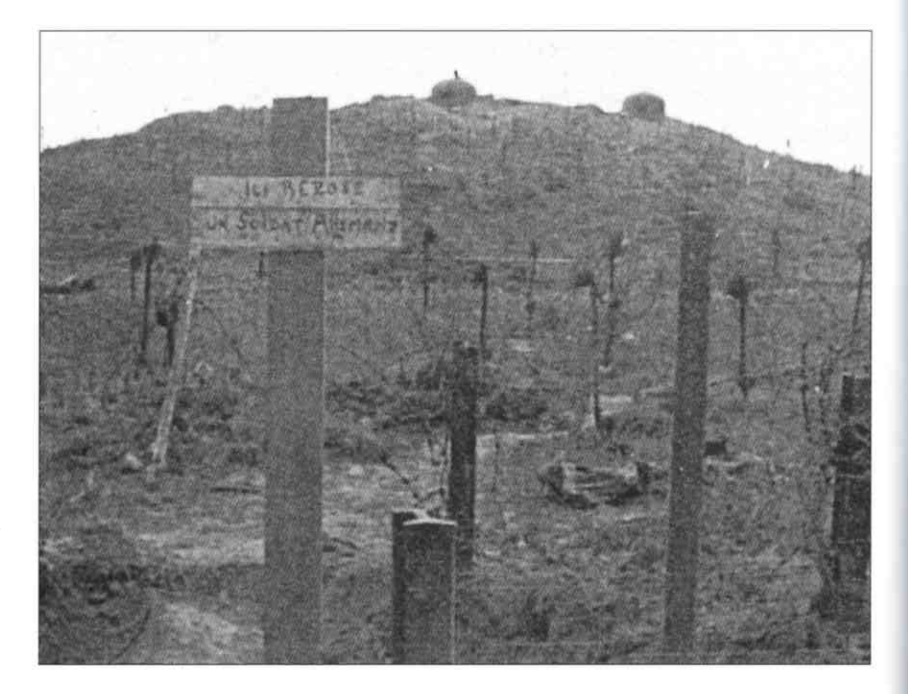
51st Infantry Division units
I/201e RI – 1st Battalion, 201st Infantry Regiment
III/27e RAD – 3rd Group, 27th Divisional Artillery Regiment
VI/227e RALD – 6th Group, 227th Divisional Heavy Artillery Regiment

LEFT **The Arrancy subsector, Metz Fortified Region** The French Army dispositions are those in May 1940, just prior to the opening of the 1940 campaign. Units of the 51st Infantry Division supported the fortress troops assigned to the subsector. By the time the area came under sustained German attack in mid-June, the 51st Infantry Division and the mobile fortress troops had been withdrawn. This made it possible for German army units to move through the small gap in the Maginot Line to the west of Longuyon, between it and the start of the Montmédy Bridgehead, and to attack the fortifications of the Arrancy subsector from the rear.



ABOVE The 1940 campaign.

The *gros ouvrages* withstood everything the Germans could throw at them and in a number of cases, gave as good as they got. On 15 June the *ouvrage* of Fermont's 75mm turret devastated a German supply column that wandered into its field of fire. On 21 June, after having been bombarded for three days by German artillery including 305mm howitzers, the *ouvrage*, with the help of artillery fire from its neighbour, the *gros ouvrage* of Latiremont, easily repelled a German assault. Throughout the fighting Fermont's garrison suffered only



'Ici repose un soldat Allemand'. The grave of a German soldier killed during the fighting and buried among the anti-tank rail area in front of the interval casemate of Oberroedern-Nord. (A. Haas)

one fatality, a soldier on duty in a *cloche* who was killed when the *cloche* was attacked by a German anti-tank gun. Around the *gros ouvrages*, the situation settled into a stalemate.

Assault across the Rhine

Meanwhile, the German units along the Rhine had prepared carefully for an assault crossing against the Rhine River fortifications, massing more than 650 artillery pieces including nearly a hundred 88mm anti-aircraft guns to support their attack in the Colmar–Selestat sector alone. The mission of the anti-aircraft guns was to fulfil an essential role in the attack. They were to utilise the superior penetrating power resulting from their high muzzle velocity to take out the river bank casemates that posed a major threat to troops attempting an assault crossing of the river. To this end individual guns were carefully sited behind camouflage netting on the bank opposite each casemate that might stand in the way of the assault.

The assault was launched on 15 June. Three minutes prior to the attack, the artillery bombardment began. The camouflaged nets screening the '88s were dropped and they opened fire on the casemates from ranges as close as 200m, each gun firing anti-tank rounds as rapidly as possible, concentrating on one spot on the exposed concrete wall of its target. The results were devastating. Within 8–10 rounds, the 1.7m reinforced-concrete walls were penetrated, knocking the casemates out of action and opening the way for the German assault troops. Total time required: as little as 35 seconds. With the river-front casemates knocked out, the mobile reserve forces withdrawn, and no artillery support, the result was a foregone conclusion. By 17 June the Rhine defences had been almost completely overrun.

Italy joins in

Hoping for a piece of the spoils, Italy declared war on the Allies on 10 June. But it was not until 20 June that the Italian Army was able to mount a serious offensive effort, attacking in several sectors along the Franco-Italian border. In spite of heavily outnumbering the French, who had not only withdrawn mobile forces to try to help hold the line in the north but who were threatened from the rear by German forces advancing down the Rhône Valley, they made



One of the German 88mm anti-aircraft guns, which played havoc with the river-edge Maginot Line casemates, is ferried over the Rhine River. (Paul Szymanski Collection)

little progress. Only in the extreme south were the Italians able to make anything approaching a significant gain. Here, by infiltrating troops through the line of advance posts, they were able to occupy the town of Menton. However, they were unable to bring up supplies because they had not actually been able to capture any of the advance posts, the most important of which was the tiny one at Pont Saint-Louis that controlled the main cross-border road, and they were under the guns of the Maginot Line *ouvrages* in the hills above the town. The offensive ground to a halt. Further north, the Italians attacked in the vicinity of several of the major Alpine passes, but in all cases they failed to penetrate the Maginot Line fortifications.

Armistice

As early as 17 June, the French government had begun to seek an armistice with Germany and on 22 June one was signed, but it was not to take effect until France and Italy had also come to an agreement. The latter was delayed while Italy unsuccessfully sought to garner some spoils of victory in the Alps. Finally, on 25 June France and Italy agreed an end to hostilities and the fighting came to a close. The terms allowed Germany to continue to occupy all of northern



Soldiers of the 42nd Fortress Infantry Regiment are marched off into captivity. The regiment was headquartered at Neuf-Brisach near Colmar and manned a portion of the Rhine River fortifications. It was cited for valour for its actions in defending against the German assault. (Paul Szymanski Collection)

Returning hostile fire, June 1940

Soldiers of the *153ᵉ Régiment d'artillerie de position* (153rd Positional Artillery Regiment) manning the 135mm casemate-mounted howitzer of block 9 of the *gros ouvrage* of Hackenberg prepare to fire on a German formation. As implied by the small size of the shell's cartridge case, the 135mm howitzer was a short-range weapon, but one that was capable of doing significant damage. On the left is a launcher for dropping grenades into the block's ditch.

Flamethrowers are effective weapons against fortifications: not only can the flame inflict damage directly, but it can also consume the oxygen inside the work, suffocating the defenders. But it takes a brave soldier and luck to get a flamethrower into range to attack a well-designed and effectively defended work such as the Maginot Line interval casemate shown here.

and western France, leaving the remainder of France nominally independent, but in fact a virtual German puppet state.

Success or failure?

When the fighting ended, the fortress troops garrisoning many of the Maginot Line works in north-eastern France and the Alps did not feel that they had been defeated. They had successfully carried out their missions, resisting everything thrown at them. Their fortifications were largely intact and they were still well supplied. They wanted to carry on the fight, believing that the reports they were hearing of surrender were enemy lies. In fact, the garrisons of several *ouvrages* refused to surrender until representatives of the French government were dispatched to personally order them to give up, and it was not until July that the last *ouvrages* surrendered and their garrisons were marched off to captivity.

Tactically, it is difficult to analyse the performance of the Maginot Line fortifications in the North East because by the time they were attacked, the interval troops and other supporting forces that formed an integral part of the defensive concept had mostly been withdrawn. While the Germans did achieve successes against some of the more isolated *petits ouvrages* that were out of supporting range of the *gros ouvrages'* artillery and against the Rhine fortifications, on the whole the fortifications held up well. Although subject to the heaviest artillery and aerial bombardment that the German forces could bring to bear, none of the *gros ouvrages* was ever seriously threatened. The German attack did, however, reveal some weakness:

- The casemates constructed along the Rhine River bank were clearly a mistake. Even allowing for the fact that the 88mm anti-aircraft gun was an unknown threat at the time they were designed, their exposed concrete faces were clearly vulnerable to hostile artillery fire.
- The *cloches* were vulnerable to direct fire from armour-piercing rounds fired by relatively heavy anti-aircraft and anti-tank guns.
- The *ouvrages* of the Montmédy Bridgehead were too far apart to provide mutual support.



German officers discuss the occupation of a *gros ouvrage* near Thionville, 26 June 1940. They are standing in front of the *ouvrage's* supplies and ammunition entrance block on the tracks of the 0.6m-gauge military railway that brought supplies to the *ouvrage*. (Paul Szymanski Collection)

Although not subjected to as severe a test as the works in the North East, the Alpine works have to be viewed as a complete tactical success. The Italians were unable to make any real progress against them. While they did manage to bypass and surround a few advance posts, they were not able to capture a single one.

Strategically, the Maginot Line's legacy is more mixed. On the one hand, it did exactly what it was supposed to do; it effectively protected the borders it was intended to protect. Its presence was a significant factor in the German decision to attack through Belgium and Holland and the Alpine fortifications easily stymied the Italian attack. On the other hand, France and its allies were crushingly defeated in spite of the supposed invulnerability of the Line. But while popular imagination seized on the Maginot Line as an abject failure that had failed to protect France, the real failure was one of leadership, most importantly, the inability of the French high command of the 1920s and 1930s to recognise and adapt to the changes that technology had brought to warfare.

Ultimately, perhaps the two biggest failings of the Maginot Line were, as General Sir Alan Brooke had so prophetically observed during the 'Phoney War', that it diverted resources, primarily money, that might have been better utilised in strengthening the French armed forces, and that the myth of the Maginot Line engendered a false sense of security and complacency on the part of the French.



ABOVE Sous-lieutenant Albert Haas standing next to an unexploded 1,000kg bomb dropped by a Ju 87 Stuka on the *gros ouvrage* of Schoenenbourg. (A. Haas)



LEFT The effects of armour-piercing anti-tank rounds on an observation and automatic rifle *cloche* of the *petit ouvrage* of La Ferté, the westernmost, and most exposed, *ouvrage* in the Montmédy Bridgehead. Although rounds that did not impact squarely ricocheted off doing little damage, at least two apparent penetrations are visible. It is possible that all or part of this damage was inflicted during German experimentation after the actual fighting ended. (Author's photograph)

1940–45

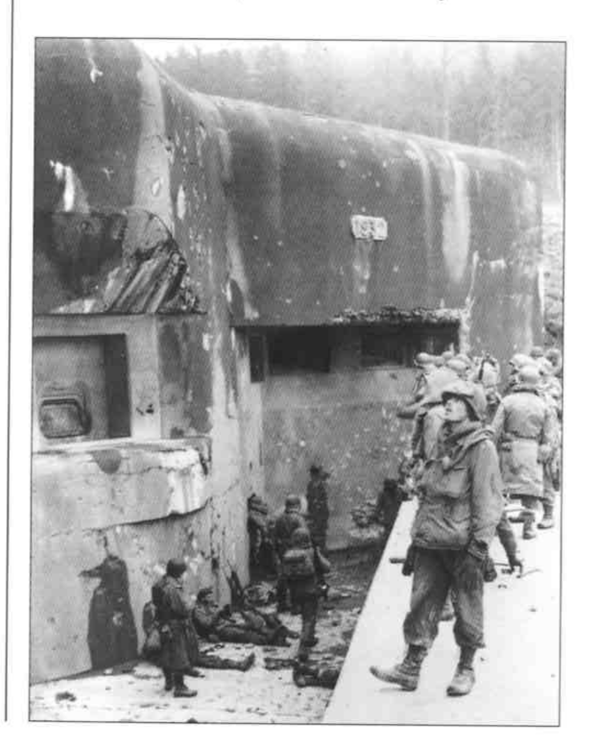
During their occupation, the Germans converted the support areas of a number of *ouvrages* into bombproof underground factories. They also removed some weapons and equipment for use in their Atlantic Wall fortifications, but on the whole they did little to alter the condition of the Maginot Line.

In 1944 a few portions of the Maginot Line saw combat for the second and what will almost certainly be the last time as the badly overmatched German forces sought any advantage that would help to stem the seemingly inexorable Allied advance across France. In early September, troops of General George S. Patton's Third US Army were able to occupy the portions of the Maginot Line north of Thionville and west of the Moselle River against token opposition. But then fierce resistance by German troops defending the strong fortifications of the old fortress of Metz, supply shortages, and the obstacle posed by the Moselle River brought the Third Army's advance to a temporary halt. The American forces used the enforced pause to study the captured Maginot Line works. New methods of attacking concrete fortifications were developed and tested and troops were trained in their use.

In early November the offensive resumed with the 90th Infantry Division making a difficult assault crossing over the flooded Moselle River east of Thionville. After securing a bridgehead, it began to advance to the south-east in conjunction with the 10th Armored Division. The main axis of advance was directly along the Maginot Line. The German troops sought to use the fortifications to strengthen their defences, but they lacked both the numbers and the extensive training necessary to employ them effectively. As a result they were for the most part only able to make use of the infantry defences. They were further handicapped by having the main attack come from along the Line and from its rear rather than from the direction for which the fortifications were intended. While there was some fighting involving Maginot Line works, it did little to slow down the Americans who made effective use of their earlier training to attack the fortifications where they were most vulnerable. For example, they positioned 155mm howitzers to pound the exposed rear concrete face of one of the *gros ouvrages* of Hackenberg's two artillery casemate blocks, rapidly knocking it out of action.

Further to the east, the German Army generally made little effort to hold the Maginot Line, preferring instead to defend their own West Wall fortifications that were located just over the border in Germany and that were oriented to defend against an attack from France. But a few troops did try to hold two of the *ouvrages* in the new-fronts area east of the Sarre Gap. One fell quickly, but there was stiff resistance at the other one before the Americans were able to capture it.

Meanwhile, in August the Allied 7th Army had successfully landed on the French Mediterranean coast and had rapidly expanded its beachhead to occupy most of south-eastern France. In the Maritime Alps, German units attempted to hold a few of the Maginot Line *ouvrages* against Allied forces approaching from their rear, but with little success.



American soldiers at the *gros ouvrage* of Hochwald in the Vosges mountains, December 1944. They are standing in front of block 13, an unusual block that combines a casemate-mounted 135mm howitzer (the left embrasure) with a standard infantry casemate block (the right embrasures). (National Archives and Records Administration)

Aftermath: the post-war era

After the war, the French Army repaired much of the damage inflicted on the Maginot Line works and in some cases completed the installation of equipment that had not been installed before the war. The fortifications were maintained until well into the 1960s by which time it was generally accepted that the possibility of France facing an invasion by land was remote and that many of the weapons installed in the Maginot Line were obsolete.

Since the underground galleries of the *ouvrages* offered a significant amount of protection against the threat posed by Soviet nuclear weapons, the support areas of a few *gros ouvrages* were turned into military command posts and other Cold War facilities. A small number of other *gros ouvrages* were also retained in caretaker status by the French Army for training purposes. But most of the Maginot Line works were either sold off or simply abandoned, in most cases with equipment that was not easily removable, including weapons, still in place.

For the next ten years, the fortifications languished in obscurity, virtually unknown and forgotten by most of the public who viewed the Maginot Line as an embarrassing reminder of France's crushing defeat in 1940. But in the 1970s, interest in the Maginot Line slowly began to revive. In 1974, Lieutenant-colonel Philippe Truttmann, writing under the penname Louis Claudel to work around the fact that the details of the Maginot Line were still classified, published *La Ligne Maginot: Conception – Réalisation*, one of the very first books to provide a technically detailed, well illustrated look at the *ouvrages* and other components of the Maginot Line. Over the next few years additional books about the Maginot Line were published presenting the public with a more balanced view of its legacy. At the same time, a few local groups, often including veterans who had served in the Line, began to see the abandoned works as potential tourist attractions.

After much work and effort, the first works were opened to the public in the late 1970s. Today, more than a dozen Maginot Line *ouvrages* and other works are open at least occasionally, drawing visitors from all over the world who come to see the Maginot Line for the technological marvel that it was.



On a recent early autumn day, visitors arrive at the supplies and ammunition entrance block to tour the restored *gros ouvrage* of Schoenenbourg. (Marc Halter)

Visiting the Maginot Line today

The strength of the reinforced concrete used to construct the Maginot Line fortifications and their massive nature mean that the vast majority of them still stand, and many can be located relatively easily with the aid of the 1:25,000- and 1:50,000-scale topographic maps published by IGN France (Institut Géographique National). Recently, however, the French government has taken steps to weld shut the doors and fill the ditches of some of the abandoned works to reduce the likelihood of intrepid explorers injuring themselves. A significant number of works, mostly *gros ouvrages*, are open to the public. Most are open only on very limited schedules, typically selected weekend afternoons from late spring through to early autumn, but there are exceptions. The following is a sample of *gros ouvrages* open to the public that are either particularly significant or that have extensive opening hours.

North-eastern France

Ouvrage de Fermont

A well-restored *gros ouvrage* with an interesting museum installed in the main magazine. Located south of the village of Fermont, approximately 5km north-east of the town of Longuyon. Open weekend afternoons from April to September, afternoons daily from June to August. The *ouvrage*'s web site is www.maginot.info

Ouvrage du Hackenberg

The largest of all the Maginot Line *gros ouvrages*. Located at the village of Veckring, approximately 20km east of Thionville. Open weekend afternoons from April to October. Telephone: 03.82.82.30.08 during opening hours or Tuesdays from 5.00 to 6.00 pm.

Ouvrage de Schoenenbourg

A very popular and well-restored *gros ouvrage*. Located north of the village of Schoenenbourg, approximately 10km south of the town of Wissembourg. Open Sundays in April and October and daily May to September. The *ouvrage's* extensive website (www.lignemaginot.com) has detailed access information as well as access information for the nearby interval casemate of Esch.

The Alps

Ouvrage de Saint-Roch

An average-sized Alpine *gros ouvrage*. Located just west of the town of Menton. Extensive opening hours from June through September.

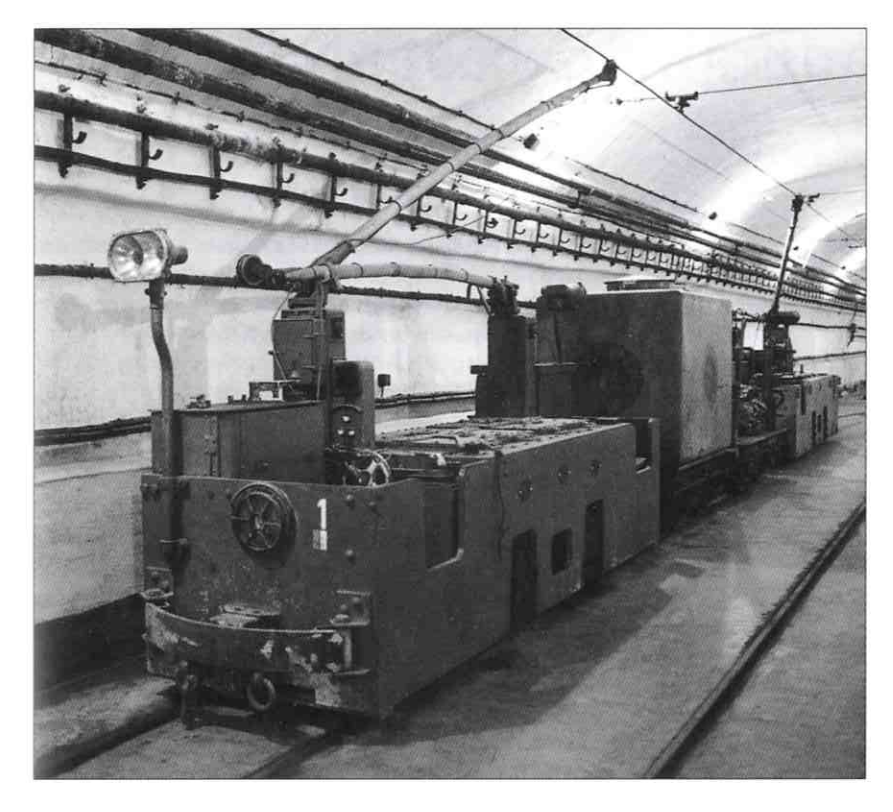
Ouvrage de Sainte-Agnès

A very compact *gros ouvrage* spectacularly sited in the village of the same name overlooking the town of Menton and the Mediterranean. Generally open afternoons in July and August and weekend afternoons the rest of the year.

Since most of the Maginot Line works that are open are operated by small local volunteer groups operating on tight budgets, open schedules can and do change frequently. Consequently, it is always best to try to verify opening times before visiting to avoid disappointment. Locating works that are open on the ground can sometimes be difficult. As might be expected, they tend to be located away from population centres and routes to them are frequently not signposted as well as they could be. Fortunately, many are marked with a fort symbol and named on the 1:200,000-scale road maps of France produced by the Michelin Group. The Michelin regional travel guides (Green Guides) for France can also be helpful. The *Alsace Lorraine Champagne* guide devotes several pages to the Maginot Line concentrating on works open to the public. The *French Riviera* guide has some information on Maginot Line works in the Maritime Alps.

Ouvrage visits generally involve a one to two-hour guided tour that normally includes the support area and at least one combat block. In most cases, significant amounts of original equipment, including weapons, are still in place. Tours are generally conducted in French, although in north-eastern France, it is not uncommon for tours to be available in German. In some cases, especially in the North East, a significant amount of stair-climbing may be required to see everything.

Much additional information about fortifications in France open to the public and about fortifications in general is available on the internet. Several useful websites are listed on the next page.



A train on the 0.6m gauge railway in the *gros ouvrage* of Schoenenbourg. At the front and rear are electric locomotives. Behind the front locomotive is a water tank car for transporting water to the combat blocks, and behind it, a flatcar. (Marc Halter)

Further reading and research

Boyer, Pierre *Les Fortifications du Briançonais*, Édisud, Aix-en-Provence, France, 1997

Bruge, Roger *Faites Sauter la Ligne Maginot!*, Fayard, Paris, 1973

Bruge, Roger *On a livré la Ligne Maginot*, Fayard, Paris, 1975

Claudel, Louis (penname for Philippe Truttmann) *La Ligne Maginot: Conception – Réalisation*, Association Saint-Maurice pour la recherche de documents sur la fortresse, Switzerland, 1974

Hohnadel, Alain and Truttmann, Michel *Guide de la Ligne Maginot – Des Ardennes au Rhin, dans les Alpes*, Editions Heimdal, 1988

Hughes, Judith *To the Maginot Line*, Harvard University Press, Cambridge, 1971

Kaufmann, J.E. and Jurga, R.M. *Fortress Europe: European Fortifications of World War II*, Combined Books, Conshohoken, Pennsylvania, 1999

Kaufmann, J.E. and Kaufmann, H.W. *Hitler's Blitzkrieg Campaigns*, Combined Books, Conshohoken, Pennsyvania, 1993

Kaufmann, J.E. and Kaufmann, H.W. *The Maginot Line: None Shall Pass*, Praeger, Westport, Connecticut, 1997

Kemp, Anthony *The Maginot Line: Myth and Reality*, Frederick Warne, London, 1981

Kemp, Anthony *The Unknown Battle: Metz, 1944*, Frederick Warne, London, 1980

Mary, Jean-Yves *La Ligne Maginot: ce qu'elle était, ce qu'il en reste*, L'Istituto Grafico Bertello, Italy, 1980

Mary, Jean-Yves *Queleque Part sur La Ligne Maginot: L'ovrage de Fermont, 1930-1980*, Sercap Editions, Paris, 1985

Mary, Jean-Yves and Hohnadel, Alain *Hommes et Ouvrages de la Ligne Maginot – Tome 1*, Histoire & Collections, Paris, 2000

Mary, Jean-Yves and Hohnadel, Alain *Hommes et Ouvrages de la Ligne Maginot – Tome 2*, Histoire & Collections, Paris, 2001

Plan, General E. and Lefevre, Eric *La Bataille des Alps: 10–25 Juin 1940*, Charles-Lavauzelle, Paris, 1982

Rodolphe, Lt Col. R. *Combats dans la Ligne Maginot*, Editions Klausfelder, Vevey, Switzerland, 1975

Rowe, Vivian *The Great Wall of France: the Triumph of the Maginot Line*, Putnam, London, 1959

Truttmann, Philippe *La Muraille de France ou la ligne Maginot*, Gérard Klopp, Thionville, France, 1985

Wahl, Jean-Bernard *Hochwald – Une forteresse en Alsace*, Editions du Polygone, Ostwald, France, 1999

Wahl, Jean-Bernard *La Ligne Maginot en Alsace*, Editions du Rhine, Steinbrunn-le-haut, France, 1987

Wahl, Jean-Bernard *Il était une fois la Ligne Maginot: Nord – Lorraine – Alsace*, Jérôme Do. Bentzinger, 1999

On the internet

A large amount of information about the Maginot Line is available on the internet. While most Maginot Line related websites are in French, some sites offer additional English or German access, but the information available in these languages may not be as complete as that available in French. The following sites are particularly extensive:

À la Ligne Maginot, www.maginot.org

Le Site Consacré à la Ligne Maginot, www.maginot67.com

There are also sites devoted to individual *ouvrages* and other works. The following are good examples that also have general information about the Maginot Line:

Alsace – La Ligne Maginot – Fort de Schoenenbourg, www.lignemaginot.com

Fort de Fermont, www.maginot.info

The Schoenenbourg site also contains a significant amount of information about the Maginot Line in general.

Finally, the following general fortification site has links to many fortification-related websites including other Maginot Line sites.

SiteO – www.siteo.net

Readers are reminded that websites, unlike books, can disappear without warning and leaving no trace.

Glossary

advance post A small work constructed forward of the main line of fortifications, intended to provide advance warning of and delay to a surprise attack.

armes mixtes (literally 'mixed arms') An infantry weapon consisting of a 25mm anti-tank gun mounted between two machine guns in a single mount.

block The general term for the reinforced-concrete structures that make up the Maginot Line. The three principal types are combat blocks, *ouvrage* entrance blocks and observation blocks.

blockhouse (*blockhaus*) A type of stand-alone infantry combat block armed only with machine guns and automatic rifles, employed primarily in the Vosges mountains in north-eastern France.

casemate A combat block in which the principal armament fires through embrasures in the block's walls. Casemates are classified as either artillery casemates or infantry casemates depending on their primary armament. Interval casemates (commonly *casemates d'intervalles*, but properly *casemates de mitrailleuses isolées*) are stand-alone, self-contained infantry casemates defending the line of anti-tank obstacles and barbed-wire entanglements between *ouvrages*.

cloche (literally 'bell') A cast steel, dome-shaped structure built into the roof of a block to provide observation and/or close-in defence.

CORF (*Commission d'Organisation des Régions Fortifiés*) The French government organisation established 1927 to provide the overall implementation of the Maginot Line programme.

fortifications de campagne (literally 'field fortifications') Fortifications ranging from substantial works to flimsy, unreinforced-concrete pillboxes constructed from about 1935 through 1940 to support the Maginot Line and in areas where no Maginot Line fortifications had been constructed.

lance-bombe (literally 'bomb thrower') A short-barrelled 135mm howitzer.

lance-grenade cloche (literally 'grenade thrower' *cloche*) A *cloche* whose roof is flush with the roof of the block in which it is installed and which was intended to mount a 50mm or 60mm breech-loading mortar.

new fronts (*nouveaux fronts*) The term used to distinguish the Maginot Line fortifications built in northern France beginning in 1934 from those of the original Maginot Line programme, the old fronts. Works of the new fronts were characterised by having a more fluid shape and a lesser complement of integral artillery.

old fronts (*anciens fronts*) The term used to identify the fortifications of the original Maginot Line programme in north-eastern France.

ouvrage (literally 'work') A collection of interconnected blocks and subterranean facilities functioning as a single unit. Sometimes referred to as a 'fort'. While there are several ways of classifying *ouvrages*, the most common is to classify them as either *petits ouvrages* (smaller *ouvrages* armed primarily with infantry weapons) or *gros ouvrages* (larger *ouvrages* armed with a mixture of artillery and infantry weapons).

Saarland The industrial border area of Germany around the city of Saarbrücken.

Sarre Gap The gap in the line of Maginot Line fortifications in north-eastern France on either side of the Sarre River.

shelter (*abri* or *abri d'intervalle*) A stand-alone block primarily providing accommodation for a troop unit whose mission it was to help defend the intervals between Maginot Line works.

turret block A combat block whose primary armament consists of a rotating and retracting machine gun, mixed arms, or artillery turret.

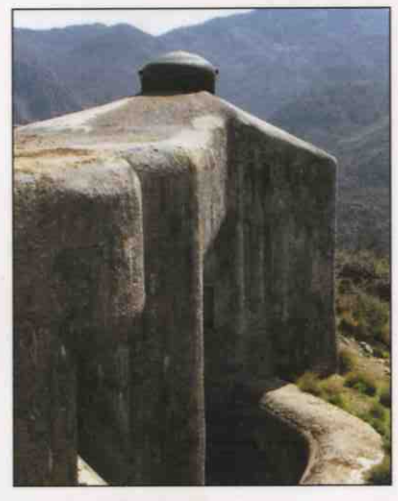
turret, mixed arms (*tourelle d'armes mixtes*) A turret armed with a combination of 25mm anti-tank guns, 7.5mm machine guns, and possibly an 80mm breech-loading mortar.

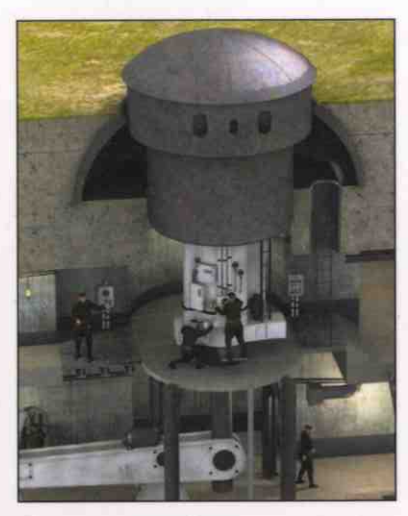
work Any self-contained component of the Maginot Line fortifications, such as an *ouvrage* or interval casemate.

Index

Design, technology and history of key fortresses, strategic positions and defensive systems


Full colour artwork


Photographs


Cutaway artwork



Unrivalled detail

The Maginot Line 1928–45

The Maginot Line, the massive series of fortifications built by France in the 1930s to defend its borders with Germany and Italy, is perhaps the most maligned collection of fortifications ever built. Despite being a technological marvel, and the most sophisticated and complex set of fortifications built up to that time, it failed to save France from crushing defeat in 1940. Yet there are those who argue that it accomplished exactly what it was designed to do. This book provides a concise and informative treatment of the Maginot Line, from North-East France to the Mediterranean. Packed with plans, contemporary and modern images and digital artwork, it presents a detailed visual exploration of this famous fortification system.

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